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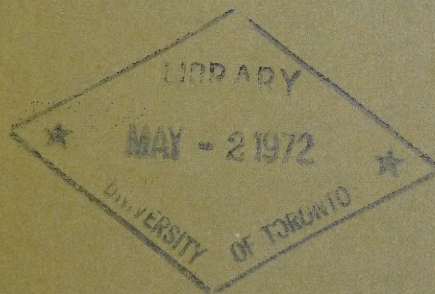
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Oil and gas north of 60

**OIL AND GAS
IN
THE YUKON TERRITORY
AND
NORTHWEST TERRITORIES**

1967



Canada

Department of Indian Affairs and Northern Development

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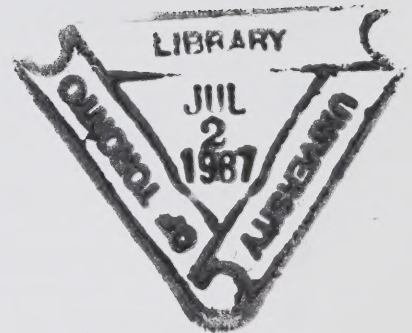
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OIL AND GAS
IN
THE YUKON TERRITORY
AND
NORTHWEST TERRITORIES

1967

Edition No. 4



Compiled By
Oil and Gas Section
Oil and Mineral Division
Northern Economic
Development Branch

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

Ottawa, Canada

November 1, 1968

Issued under the Authority of the
Honourable Jean Chrétien, P.C., M.P., B.A., LL.L.
Minister of Indian Affairs and Northern Development

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT



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Cat. No.: R2-3169

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PREFACE

This report is prepared annually: to summarize oil and gas exploration activities on Canada's lands north of latitude 60°, which are administered by the Department of Indian Affairs and Northern Development, to compile and summarize all known sources of information, and to list names of government agencies which have various interests in the north.

Statistics on operations and land activities included in this report are based on the calendar year, whereas financial and revenue statistics are based on the fiscal year which ends on March 31. All the statistical and administrative data were compiled from Oil and Mineral Division files, geological information was obtained from officers of the Geological Survey of Canada and from reports and memoirs published by that organization. A detailed review of exploratory activities of the various oil companies and individuals involved is not included as much of this type of information is regarded as confidential.

This is the fourth number of this report, previous edition on past activities, can be obtained from the "No. 1 Statistical Report on Oil and Gas Activities 1920 – 1960". No. 2 Statistical Report is now being compiled.

Copies of this report can be obtained from the Chief, Oil and Mineral Division, Ottawa, or the Oil Conservation Engineer, Department of Indian Affairs and Northern Development, 3303 – 33rd. N.W., Calgary 44, Alberta.

INTRODUCTION

All aspects of oil and gas operations in the Yukon and northwest Territories are administered by the Department of Indian Affairs and Northern Development, specifically by the Oil and Gas Section of the Oil and Mineral Division. It is the intent of the Department to provide for the orderly exploration and exploitation of oil and gas, thereby achieving benefits of a local nature to the specific areas involved and to the people of Canada in general through the attendant revenues accruing to the Crown.

The Minister and officers of the Department of Indian Affairs and Northern Development who are responsible for administering oil and gas resources in the Northwest Territories and Yukon, and northern offshore areas, are

Minister	— Hon. Jean Chrétien, P.C.
Executive Assistant	— J. Rae
Special Assistant	— J.T. Fournier
Commissioner of the Yukon	— J. Smith
Commissioner of the N.W.T.	— S.M. Hodgson
Deputy Minister	— J.A. MacDonald
Assistant Deputy Minister — Economic Development	— J.B. Bergevin
Director — Development Branch	— A.D. Hunt
Chief, Oil and Mineral Division	— Dr. H.W. Woodward
Administrator, Oil and Gas	— Dr. H.W. Woodward
Supervisor, Geological Operations Unit	— S.A. Kanik
Supervisor, Geological Evaluation Unit	— J. Hawryszko
Supervisor, Land Unit,	— P. Sullivan
Oil Conservation Engineer	— B.H.J. Thoms, Calgary, Alberta.

Norman Wells is the only producing oil field north of the 60th parallel in Canada. The field was discovered in 1920, but intensive commercial development did not take place until World War II. During 1967 oil was produced at an average rate of approximately 1874 barrels daily.

Several significant gas flows and a few good oil shows have been encountered in other areas, but these finds have not been commercially exploited as yet, due to lack of suitable market outlets within economic reach.

Oil and Gas Permits in effect in the north as of December 31, 1967 covered approximately 198 million acres, as follows: 98 million acres on the Northwest Territories mainland, 14 million in the Yukon and 74 million in the Arctic Islands area and over 10 million acres offshore along the Arctic Coast (Map 1). Oil and Gas leases in effect in the north as of December 31, 1967, covered over 1 million acres; 950 thousand in the Northwest Territories mainland and 75 thousand in the Yukon.

MAP 1
CANADA LANDS
OIL AND GAS ADMINISTRATION
Scale of Miles
0 100 200 300

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT
OIL AND MINERAL DIVISION
LEGEND

Canada Lands in The Yukon Territory
and Northwest Territories Under Permit or Lease

- Arctic Islands
- Mainland Northwest Territories
- Yukon Territories
- Water Seacoast
- Oil Well
- Gas Well
- Oil & Gas Well

CANADA LANDS ARE ADMINISTERED BY THE DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT, NORTHWARD OF THE HEAVY LINE. OFFSHORE AREAS ELSEWHERE ARE ADMINISTERED BY THE DEPARTMENT OF ENERGY, MINES AND RESOURCES.

NOV. 31, 1968

Arctic Ocean
80°
70°
60°

YUKON TERRITORY
DAWSON
CHIN
LESTER
BURCH
BLACKIE
INUVIK
NORTHWEST TERRITORIES
VICTORIA ISLAND
RESOLUTE
WHITEHORSE
POINT
NORTH
FIELD WELLS
NORTH
TRAINING
RIVER
FISH RIVER
FORT SMITH
ALBERTA
SASKATCHEWAN
MANITOBA
Hudson Bay
Churchill
CUBEC

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SASKATCHEWAN
MANITOBA
BRITISH COLUMBIA
WHITEHORSE
POINT
Nestio
Rabot
Trainor
Fort Smith
R. River

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Dog River
Whitehorse
POINT

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Whitehorse
POINT

HISTORICAL REVIEW OF OIL AND GAS ACTIVITIES

Alexander Mackenzie observed oil seepages on his journey from Fort Chipewyan on Lake Athabasca to the Arctic Ocean and back in the summer of 1789. At only one place, namely the lower Ramparts, did Mackenzie record a substance that he called "petroleum". In 1890, McConnel observed oil seepages and "tar springs" on the north shore of the Great Slave Lake and near Fort Good Hope. It was from the latter area that the Hudson's Bay Company obtained its principal supply of pitch for waterproofing canoes and boats.

The first well in the Great Slave Lake area was drilled by the Northwest Company (Imperial Oil Limited) in 1921. It was not until 1946 that exploration was resumed in the area with the drilling of a series of structure test holes south of the settlement of Hay River. From 1952 to the present, exploratory drilling has been continuous and on a gradual increase.

The Eagle Plain area of the Central Yukon attracted the attention of many oil companies in the early 1950's. In 1958, the first well was drilled and abandoned. A subsequent well, Western Minerals Chance No. 1, discovered significant quantities of oil and gas in 1960 and is now standing as a suspended oil and gas well. Two one-mile stepouts from the Chance No. 1 well have been drilled resulting in one oil well and one gas well and additional drilling in the area has resulted in the discovery of two other gas pools.

Preliminary geological investigations of the Arctic Islands were commenced in the early 1950's by the Geological Survey of Canada and indicated the presence of thousands of feet of sediments, some of which are potential oil and gas reservoirs.

In 1960, over 50 million acres in the Arctic Islands were filed on by oil companies. By 1961, the first well was spudded on Melville Island and completed in 1962 at a total depth of 12,543 feet. Two more wells were drilled in 1963 and 1964. Though no oil and gas shows were recorded, the wells penetrated hundreds of feet of porous carbonates which could be prolific oil and gas reservoirs in other areas of the Islands.

NORMAN WELLS FIELD

It was not until 1911 that explorers became aware of the oil seepages at the site of the present Norman Wells field. In 1919, these seepages were examined by the Northwest Company and new ones as well as many gas seepages were discovered nearby.

The Discovery No. 1 well in what is now known as the Norman Wells field was located in 1919, and drilling commenced in 1920. Oil was encountered in fractured zones in the shale. Subsequent drilling established the presence of an oil bearing reef which is the main reservoir. It was during the Second World War that the Norman Wells field was developed, and the highest output from the field, 3,368 barrels of oil daily, was achieved in 1944. The field was linked to the Whitehorse refinery by the Canol crude oil pipeline in 1944; operations ceased in 1945 when the war threat to North America was eliminated. Since 1945, production has varied from 1,500 to 2,100 barrels per day, depending on refinery capacity. As a result of development of the field during and after the War, 66 oil wells have been completed; 63 are still capable of production.

Production is obtained from wells on the northern bank of the river known as the Mainland or Discovery Area and from wells on Goose and Bear Islands. These islands are situated in the middle of the Mackenzie River west and south of the Mainland respectively.

The Norman Wells oil reservoir is a coralline limestone reef located between an upper and lower series of the Devonian. The porous portion of the reef rests on a basal reef limestone about 100 feet thick, which extends over a wide area beyond the productive limits of the pool. The structure dips uniformly in a

southwesterly direction at an angle of approximately four degrees (corresponding to a slope of 369 feet per mile). Updip the oil saturated section is limited by a pinchout of the reef while on the down-dip side edgewater limits the productive outline.

Although 63 wells are capable of production, until 1964 all the wells on Goose Island were capped due to ice-rafting conditions in the spring. Well-head equipment is now safeguarded by placing it in cement cellars and shutting down production during spring break-up.

In 1967, Imperial Oil Limited produced an average of 1,874 barrels crude oil daily and refined it locally. Middle distillates are in largest demand, thus leaving a surplus in lighter and heavier distillates. The surplus lighter products in the past have been re-injected, while the heavier residual is usually burned.

Additives and alkylates for blending are brought in from Edmonton to provide premium motor and aviation gasoline for the local market. Production from this refinery supplies aviation, motor gasolines and diesel oil to settlements along the Mackenzie River and Arctic Coast, and the DEW Line Stations.

SEDIMENTARY GEOLOGICAL PROVINCES

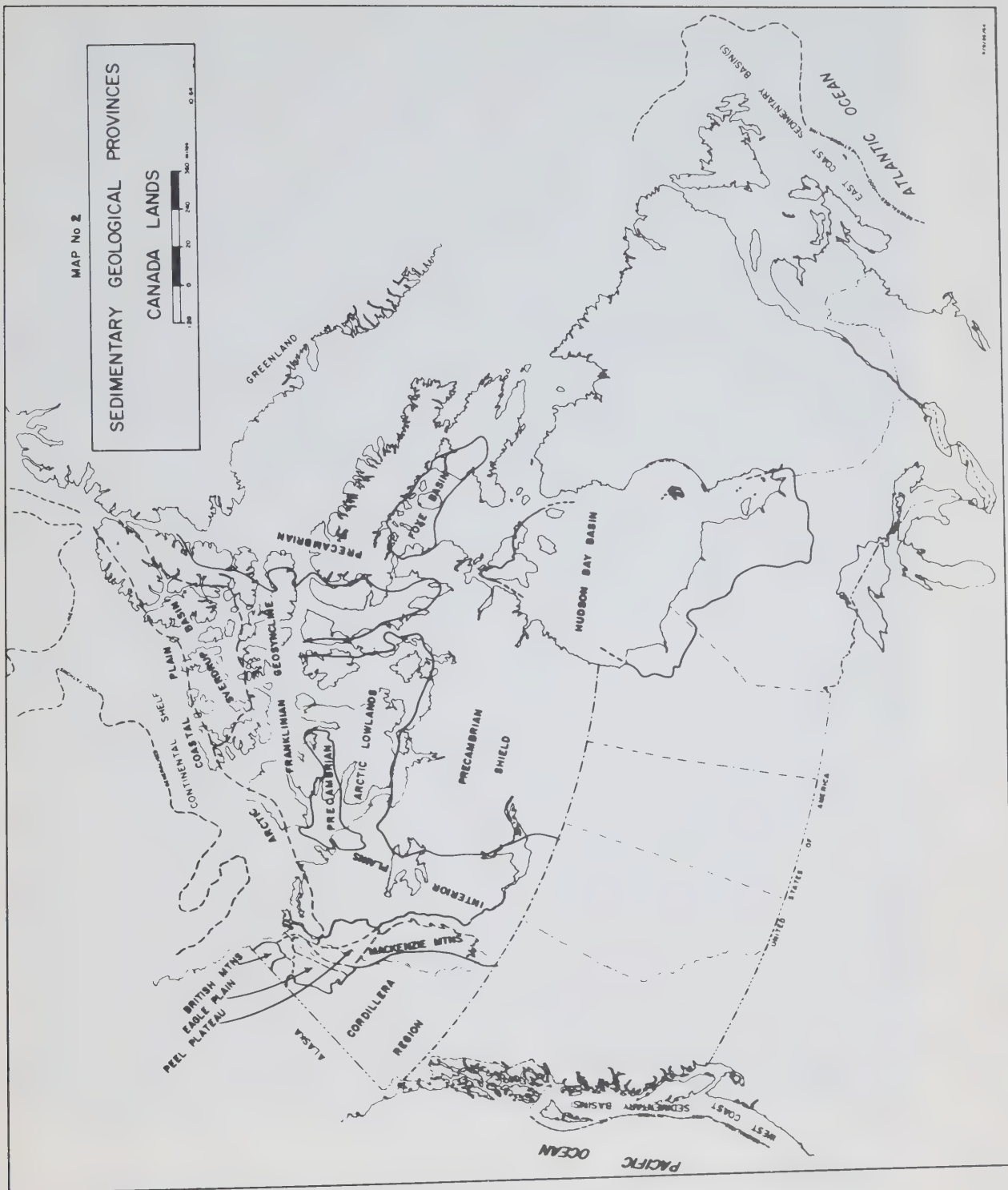
In Canada, north of latitude 60°, the areas outside the provinces contain 1,458,784 square miles, of this a total of 465,000 square miles are underlain by sedimentary rocks (Map No. 2) ranging from Cambrian to Tertiary that are considered to be potentially productive of oil and gas. The vast Territories sedimentary region can be divided conveniently into several geological provinces each characterized by specific features of the contained sediments or structures in which they are involved. A summary of the sedimentary character of the geological provinces was given in editions Nos. 2 and 3 of this report. The summary is not repeated here inasmuch as Geological Survey of Canada Paper 63-31, *Geology and Petroleum Potentialities of Northern Canada*, by R.J.W. Douglas, D.K. Norris, R. Thorsteinson and E.T. Tozer, contains an excellent résumé of the geology of northern Canada and may be reviewed for further details. Other reference on the geology of northern Canada is listed in Appendix IV. The reports listed for the Sverdrup Basin and Franklinian Geosyncline are in large part also applicable to other basins in the Arctic Archipelago.

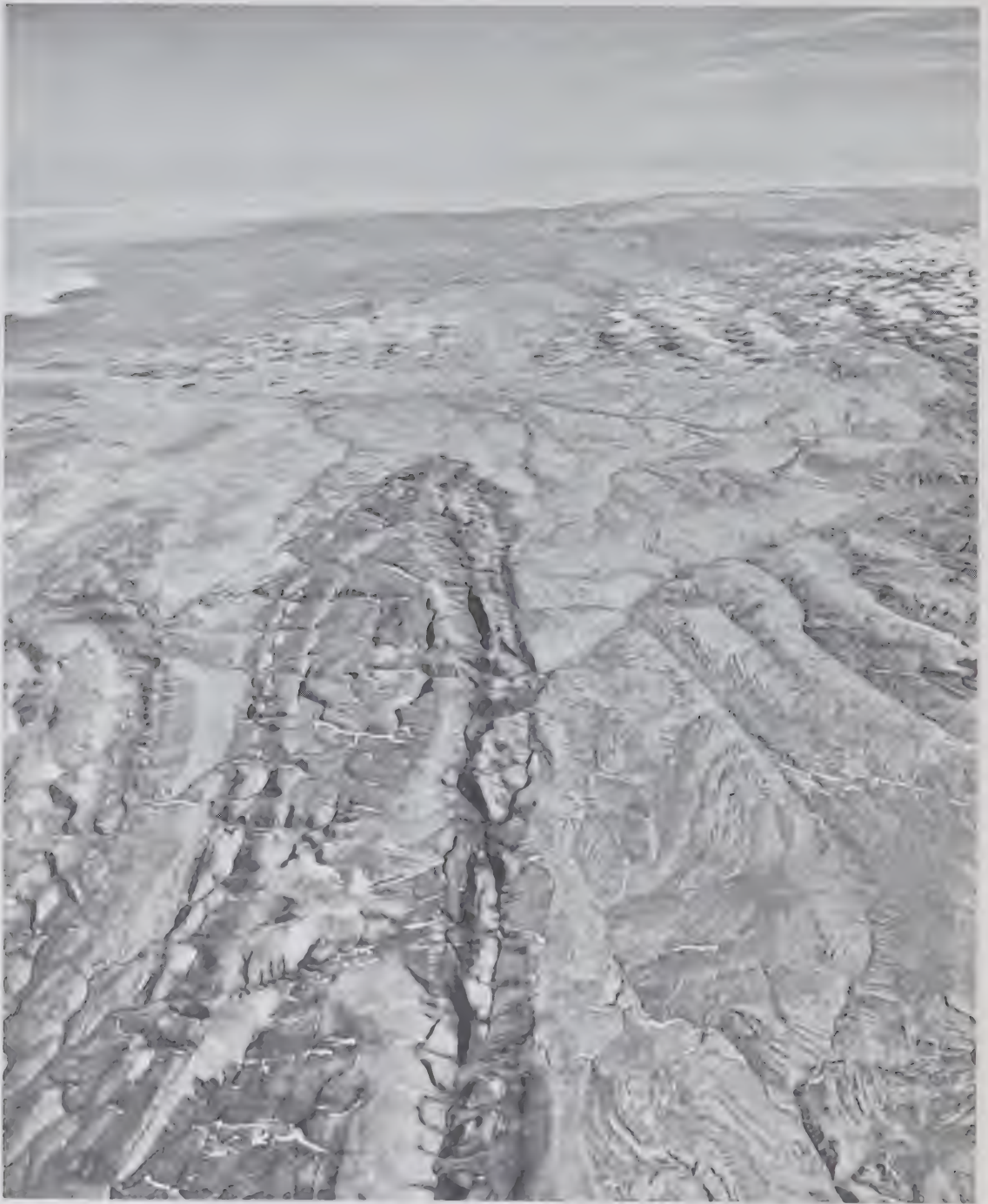
AREA AND VOLUME OF SEDIMENTS

In sedimentary areas which are relatively unexplored by drilling, there are various ways in which an estimate of the possible oil and gas potential may be made. One of the more commonly used methods is that of estimating the volume of sediments within the basins and comparing these with other sedimentary basins of the world in more advanced stages of development. In the estimates given here, the calculations exclude all sediments where the total section is less than 1,000 feet thick as well as that part of sections exceeding 16,000 feet inasmuch as such sediments are, at present, considered to be only marginally attractive.

The area of the Arctic Islands underlain by sedimentary rocks is about 350,000 square miles. Since the measured and estimated stratigraphic sections are widely dispersed, as approximation for the average thickness was taken to be 10,000 feet; thus a volume of 663,500 cubic miles is estimated. The mainland areas of the Yukon and Northwest Territories underlain by sedimentary rocks are about 43,000 square miles and 205,000 square miles respectively; the volume of sediments is about 64,500 cubic miles and 267,000 cubic miles respectively. The total mainland area underlain by sedimentary rocks is 248,000 square miles and the volume of sediments 331,500 cubic miles.

A comparison of the sedimentary areas and volumes in the western provinces and in the Yukon and Northwest Territories and Arctic Islands is given in Table No. 1.





Canrobert Hills, Melville Island. Looking east at the Paleozoic rocks of the Parry Islands Fold Belt. This zone of tectonic disturbance lies between the thick sediments of the Sverdrup Basin to the north and the Arctic Lowlands to the south where Precambrian rocks are covered by a thin Paleozoic sequence.



Isachsen Dome, Ellef Ringnes Island. Piercement core of gypsum and anhydrite is surrounded by upturned Lower Cretaceous sediments. The dome has a diameter of 5 miles.

National Air Photo Library Photo T428L - 121

TABLE NO. 1**Volume of Sediments**

	Area (Sq. Miles)	Volume of Sediments (Cu. Miles)
Manitoba & Saskatchewan	176,623	168,072
Alberta	236,893	341,715
British Columbia	50,688	115,318
Yukon	43,000	64,500
Northwest Territories	204,794	267,133
Arctic Islands	350,000	663,500
	<hr/> 1,061,998	<hr/> 1,620,238

OIL AND GAS REGULATIONS

Regulations in effect for oil and gas administration are made pursuant to the Territorial Lands Act, and Public Lands Grants Act, and include:

- Canada Oil and Gas Land Regulations
- Oil and Gas Land Order No. 1 — 1961 (Amended 1961)
- Oil and Gas Land Order No. 2 — 1961 (Amended 1964)
- Oil and Gas Land Order No. 1 — 1962 (Amended 1964)
- Canada Oil and Gas Drilling and Production Regulations

CURRENT LAND ACTIVITY

Map No. 1 of northern Canada shows the areal disposition of permits on Canada lands. This is a condensation of information on oil and gas permits and availability of land for filing taken from large scale maps which are available from the Chief, Oil and Mineral Division, Ottawa, or from the office of the Oil Conservation Engineer, Calgary. Table No. 2 indicates the number of acres held under oil and gas permits in each area or territory at the end of 1967.

TABLE NO. 2**No. of Permits and Leases and Relevant Acreage
December 31, 1967**

Permits	Number	Acreage
N.W.T. Mainland	2,072	98,277,668
Yukon Mainland	304	14,107,280
Arctic Islands	1,658	74,117,200
Water — Arctic Coast	223	10,466,863
TOTAL FOR PERMITS	<hr/> 4,257	<hr/> 196,969,011
Leases		
N.W.T. Mainland	159	953,510
Yukon Mainland	17	75,359
Arctic Islands	NIL	NIL
Water — Arctic Coast	NIL	NIL
TOTAL FOR LEASES	<hr/> 176	<hr/> 1, 1,028,869

The Canada Oil and Gas Land Regulations came into effect June 6, 1961. The Regulations provide for an applicant to select a grid area from a master map held in the Oil and Mineral Division at Ottawa showing all grid areas already under permit and those still available. An applicant may apply for any grid area which is available for filing and be granted a permit entitling him to explore for oil and gas.

The applicant shall pay a fee of \$250. per permit and deposit money, bonds or a promisory note to guarantee that exploratory work will be conducted. The amount of expenditure on exploratory work required during the life of the permit is \$2.90 per acre on the mainland, \$2.65 per acre for the Arctic Islands and \$2.70 for water permits. The work expenditure requirement commences at five cents per acre and escalates to 50 cents per acre during the original and renewal terms of the permit.

The deposits which are required to ensure work are returned upon satisfactory performance. Permit terms and work requirements are illustrated in Figures 1 and 2. Permits on the mainland are issued for original terms of four or six years depending on location and with six renewal terms of one year each. Marine permits under seacoast waters have an original term of six years with six renewals of one year each. All permits north of latitude 70° issued prior to 1968 have an original term of eight years with six renewal terms; permits issued in 1968 and later, have an original term of six years with six renewal periods.

A permittee may acquire a lease covering not less than one section and not more than fifty per cent of the sections in each grid area or half-grid area for which he has a permit. Leases are valid for twenty-one years and are renewable. The rental is fifty cents per acre for the first year, and in the second and subsequent years is \$1.00 per acre. Up to fifty per cent of the annual rental can be in the form of unallocated work expenditures carried forward from the permit stage, and these surpluses may be credited against the rental until the expiration of the lease or until the start of commercial oil or gas production.

The fifty per cent of the permit not acquired under lease by a permittee returns to the Crown. On October 12, 1961, two Oil and Gas Land Orders were made granting a permittee an option to acquire the Crown's portion on the payment of an additional royalty which varies with location and production rates (see Figure No. 3). If the option is not exercised, the lands returned to the Crown may be sold by tender as oil and gas leases by one of three methods: cash bonus, work bonus or cash bonus plus an undertaking to drill a well to a specified depth.

On September 17, 1962, a third Land Order was made setting out methods for disposal by permit of lands returned to the Crown. The methods to be used are sale by tender of single permits or blocks of permits for a work bonus or a cash bonus. Figure No. 4 shows the flow of land transactions in permits and leases.

Figure No. 5 graphically illustrates the total acreage held under oil and gas permits during the past eighteen years.

Water permits are those where the whole or greater part of a permit area is, in the opinion of the Chief, covered by seacoast water and are issued in northern waters between the Arctic Mainland Coast and Latitude 70°. All permits issued north of latitude 70° are Arctic Islands permits, irrespective of their location with regard to water or land. Northwest Territories permits are issued on the mainland of the Northwest Territories south of latitude 70° and similarly, Yukon permits are those issued on the mainland of the Yukon Territory. Arctic Islands and water permits were first issued in 1960 and today comprise more than one-third of the total acreage administered by the Department.

Land activities in 1967 were highlighted by an increase in oil and gas permits totalling approximately 12,000,000. The land holdings remained fairly constant at about 14,000,000 acres in the Yukon (Figure No. 5) but over 10,000,000 acres were filed on the Arctic Islands. The discovery of oil and gas in Zama Lake in Alberta lead to increased activity in the southern Northwest Territories and northwest along the Makenzie River.

Fig. 1
ILLUSTRATING
PERMIT TERMS AND DEPOSIT
REQUIREMENTS PER ACRE

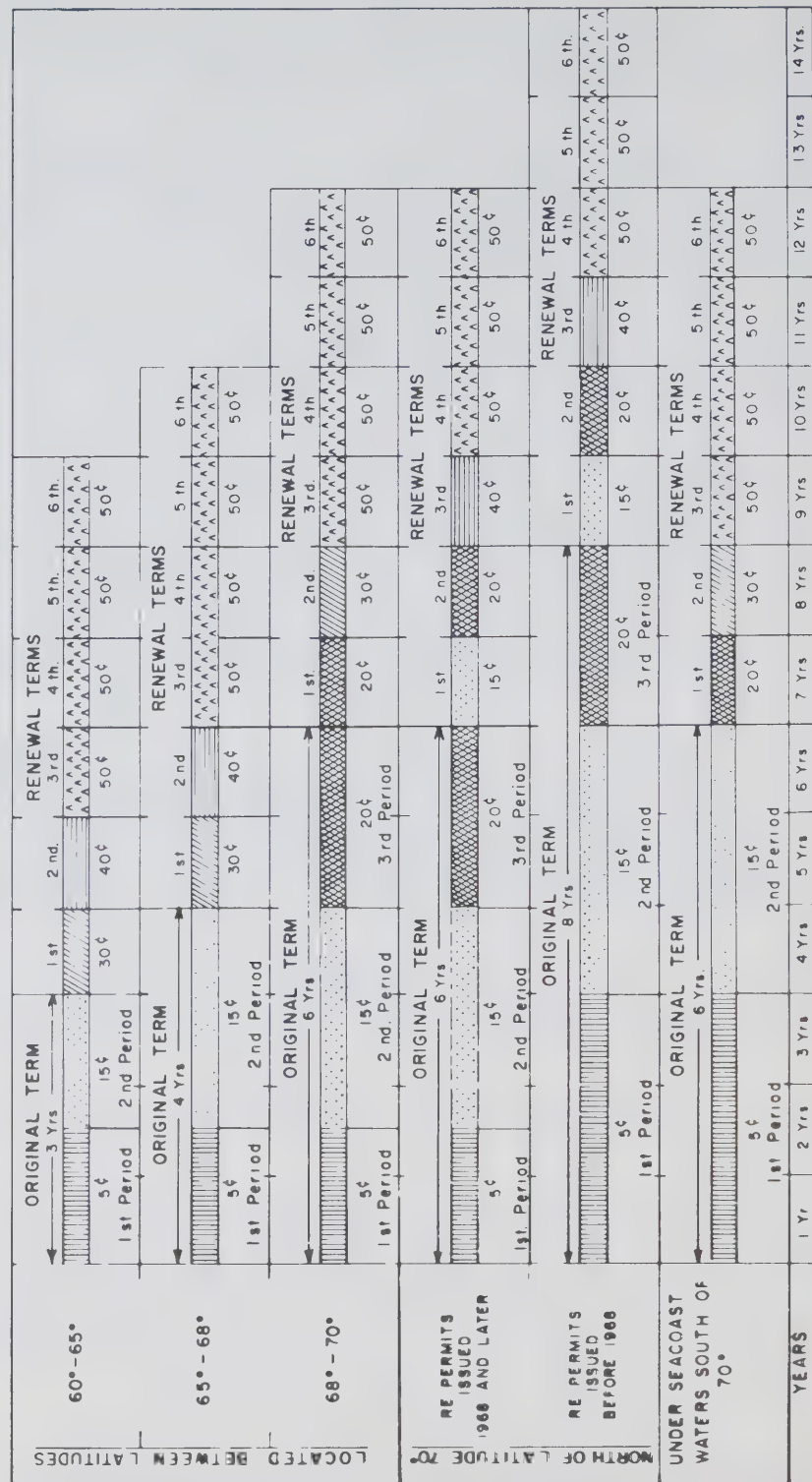


Fig. 2

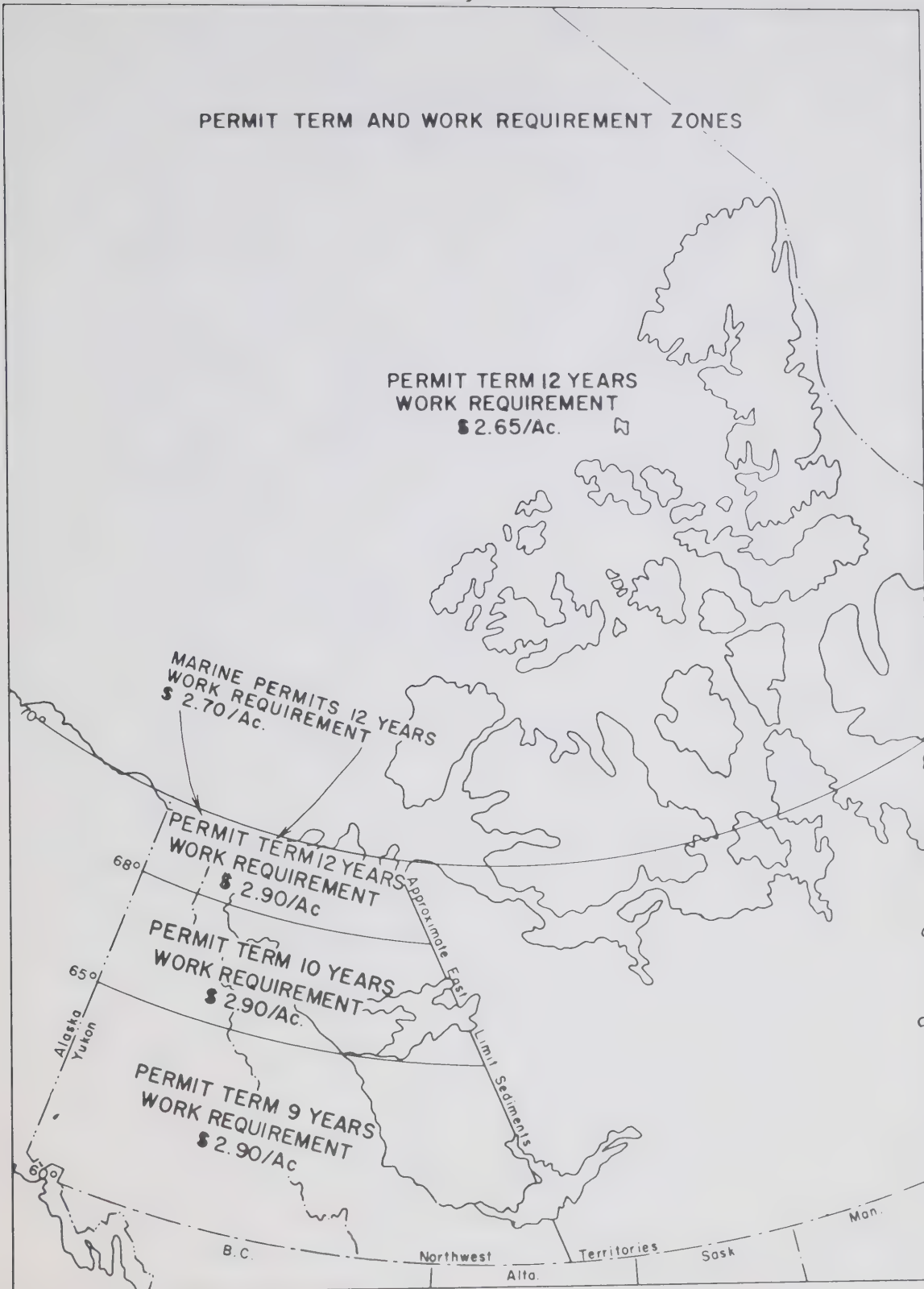


Fig 3

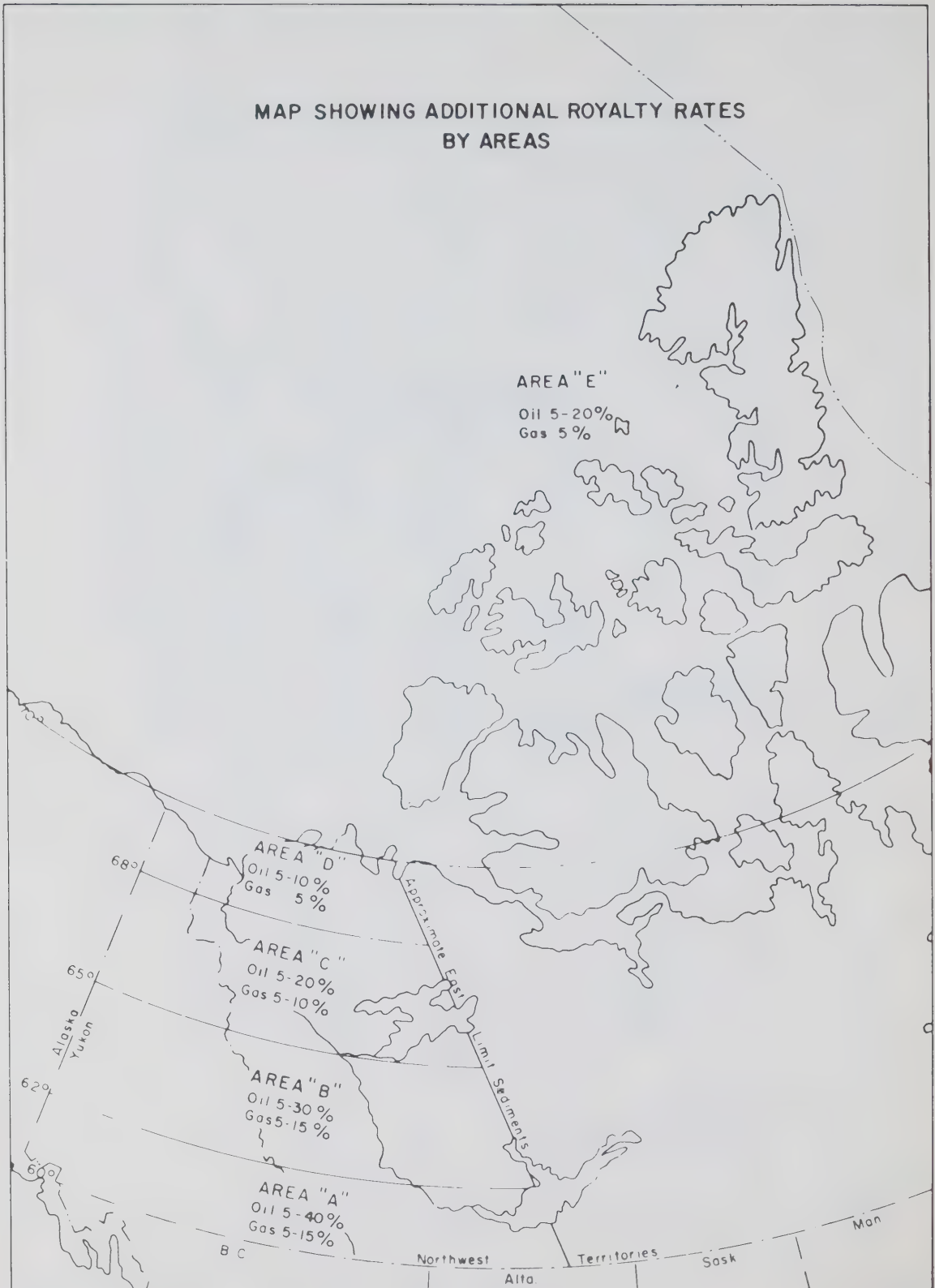
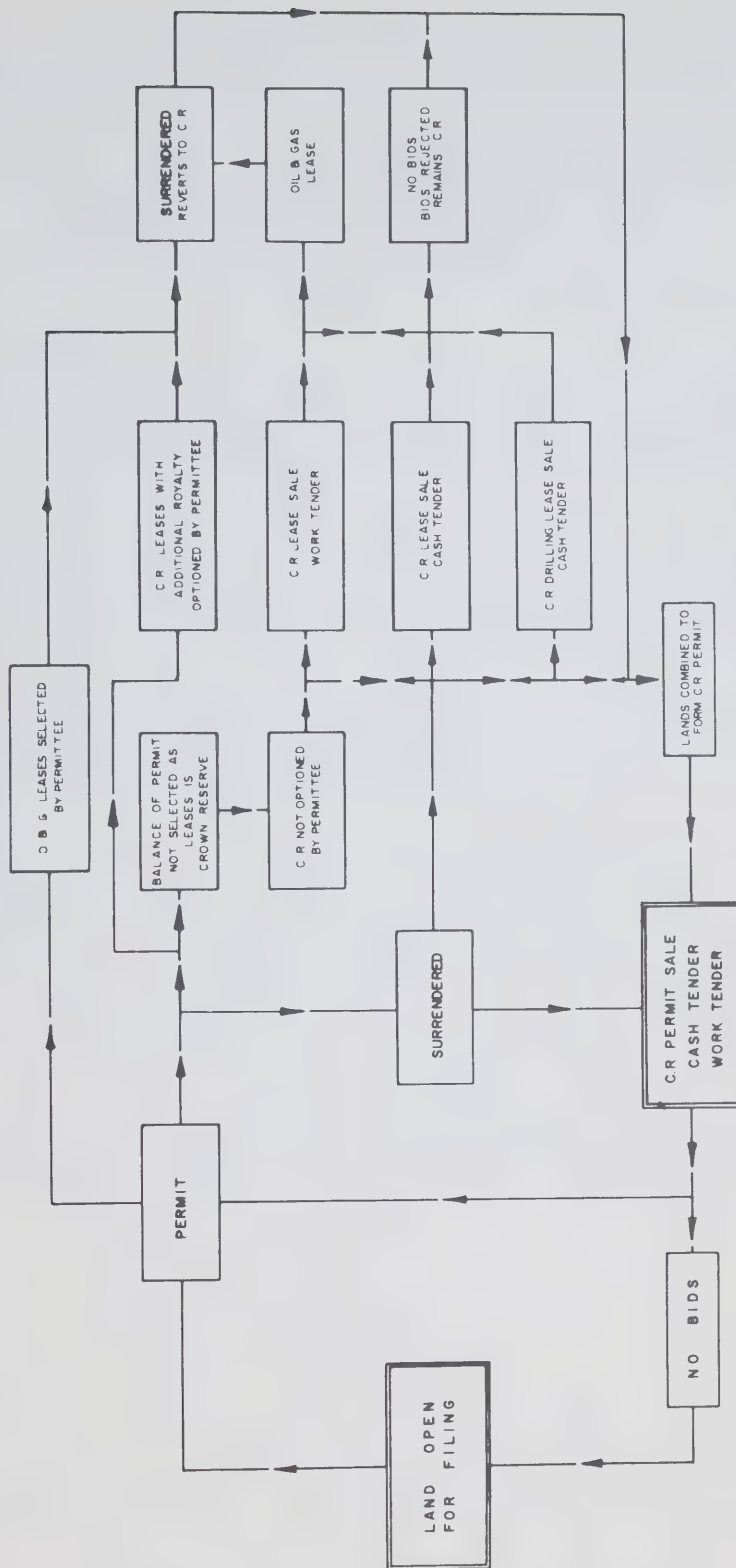


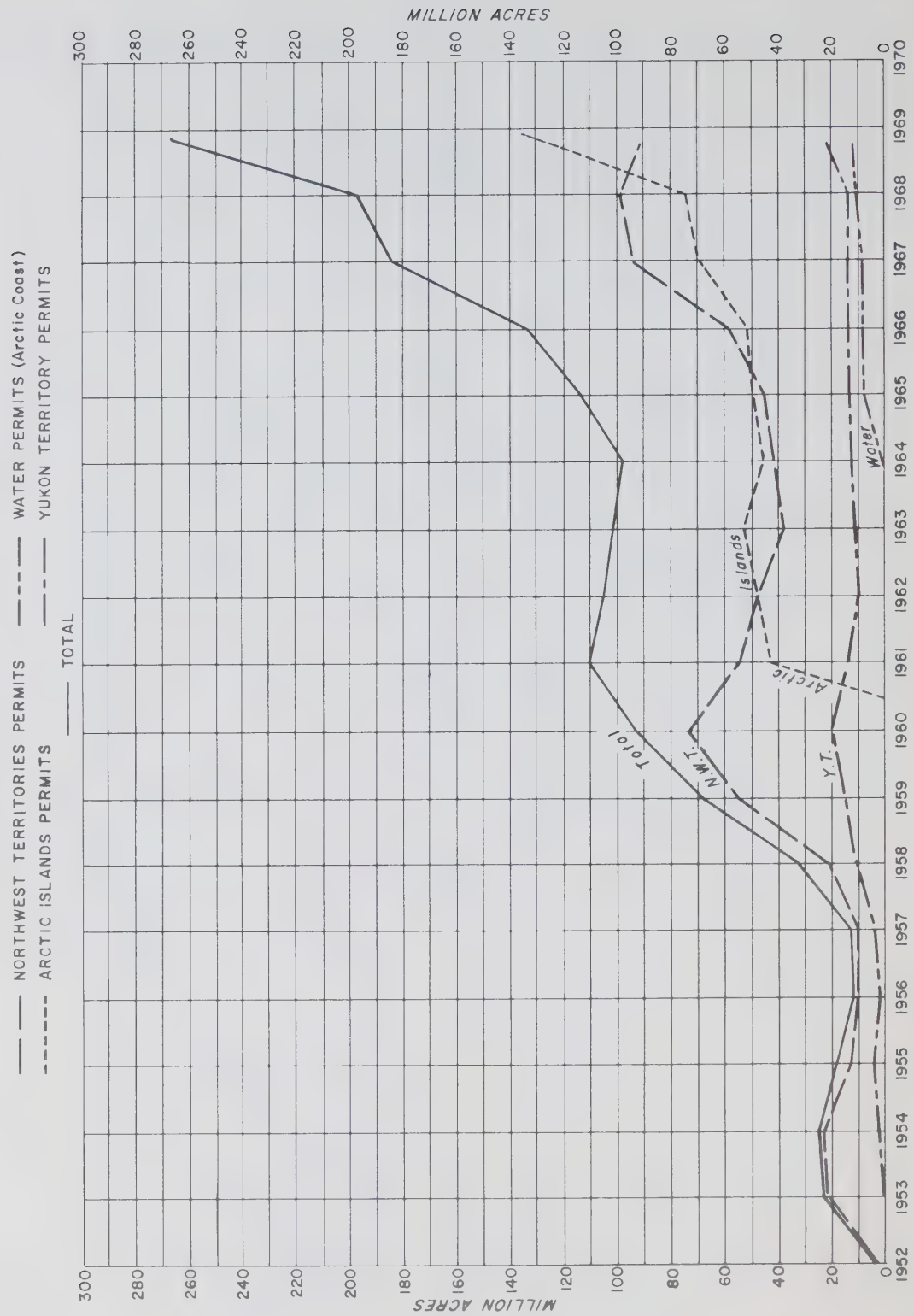
Fig. 4
FLOW CHART SHOWING METHODS OF OIL & GAS LANDS DISPOSAL
YUKON TERRITORY AND NORTHWEST TERRITORIES
Oil and Gas Section - Oil and Mineral Division



Note: "C.R." means Crown Reserve, a term applied to Oil and Gas Lands available for acquisition by tender only

Fig. 5

ACREAGE HELD UNDER OIL & GAS PERMIT YUKON TERRITORY AND NORTHWEST TERRITORIES



On acquisition of an oil and gas permit, oil companies must spend at least five cents per acre (see Figure No. 1) for the first 18 months on the mainland and Arctic Islands and a similar amount for the first three years on marine permits between latitude 70° and the mainland. In past years, many of the oil companies initiated their exploration program by conducting surface geologic surveys augmented by gravimeter and aeromagnetometer surveys. This is usually followed by seismic surveys during the second period in the life of the permit. Since most companies have now completed their comprehensive surface mapping programs, there has been a significant decrease in "geological party months" with a consequent increase in "seismic" work. This trend will continue as more companies undertake seismic work to define well locations.

Exploration Activities – 1967

There was a considerable increase in exploration activities in 1966. While the number of geological crew-months, defined as a two-man geological surface party working on month showed a slight decline (Fig. 6) the number of seismic crew months, defined as one self-contained seismic party working 260 hours, showed a large increase.

Exploratory expenditures, which depict the magnitude of all activities, are graphed in Figure No. 7. Exploratory expenditures are direct field expenditures with a maximum of 12½% included for overhead. These expenditures do not include field expenditures by Imperial Oil Limited at the Norman Wells field.

Information on oil industry expenditures can be obtained also from the annual "Net Expenditure Survey" carried out by the Dominion Bureau of Statistics and the Canadian Petroleum Association. The survey is conducted on a national level in each province or territory. Table No. 3 gives a summary of the expenditures by the oil industry in the Yukon and Northwest Territories, itemized by type of activity in 1965, 1966 and 1967.

The annual footage drilled on Canada Lands is illustrated in Figure No. 8. Drilling footages are recorded in the year the well was abandoned or completed; the figures do not include structure test holes or holes drilled for reasons other than exploration for oil and gas. Drilling has been on a steady increase since 1964, and in 1968 has already surpassed the 1967 figure. During the last year, drilling has been concentrated in the southern Territories due to oil and gas discoveries in Alberta and British Columbia. In 1968, the trend will be for more wells to be drilled along the Mackenzie Valley and Arctic Lowlands.

The number of wells drilled per year is illustrated in Figure No. 9. The number of completions and abandonments has increased every year. Though the 1967 figure includes many shallow stratigraphic tests, there were several significant deep wildcats along the foothills region (see map illustrating distribution of wells drilled in 1967, Map No. 3).

Fig. 6
EXPLORATION ACTIVITY
YUKON TERRITORY AND NORTHWEST TERRITORIES

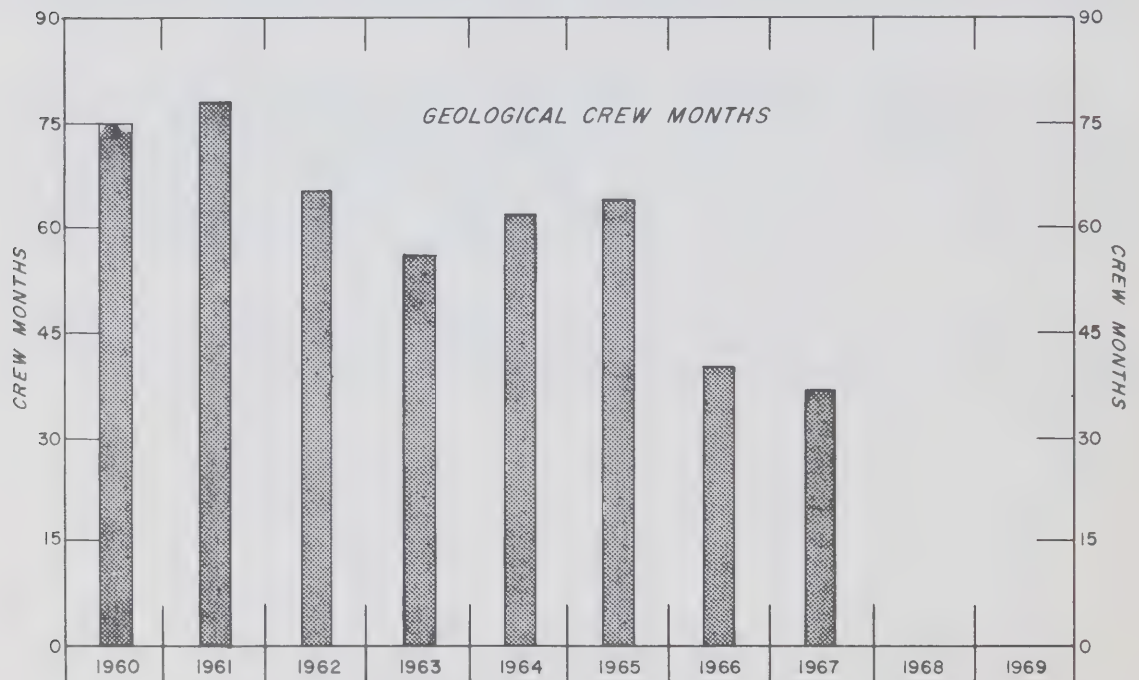
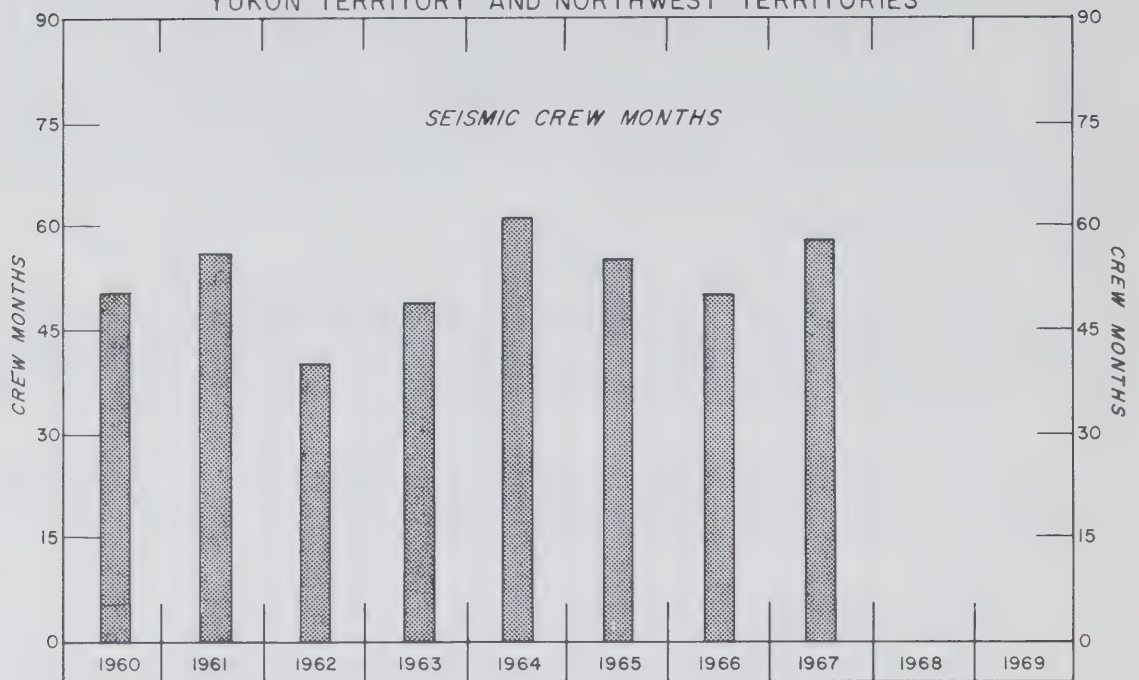


Fig. 7

OIL & GAS EXPLORATORY EXPENDITURES

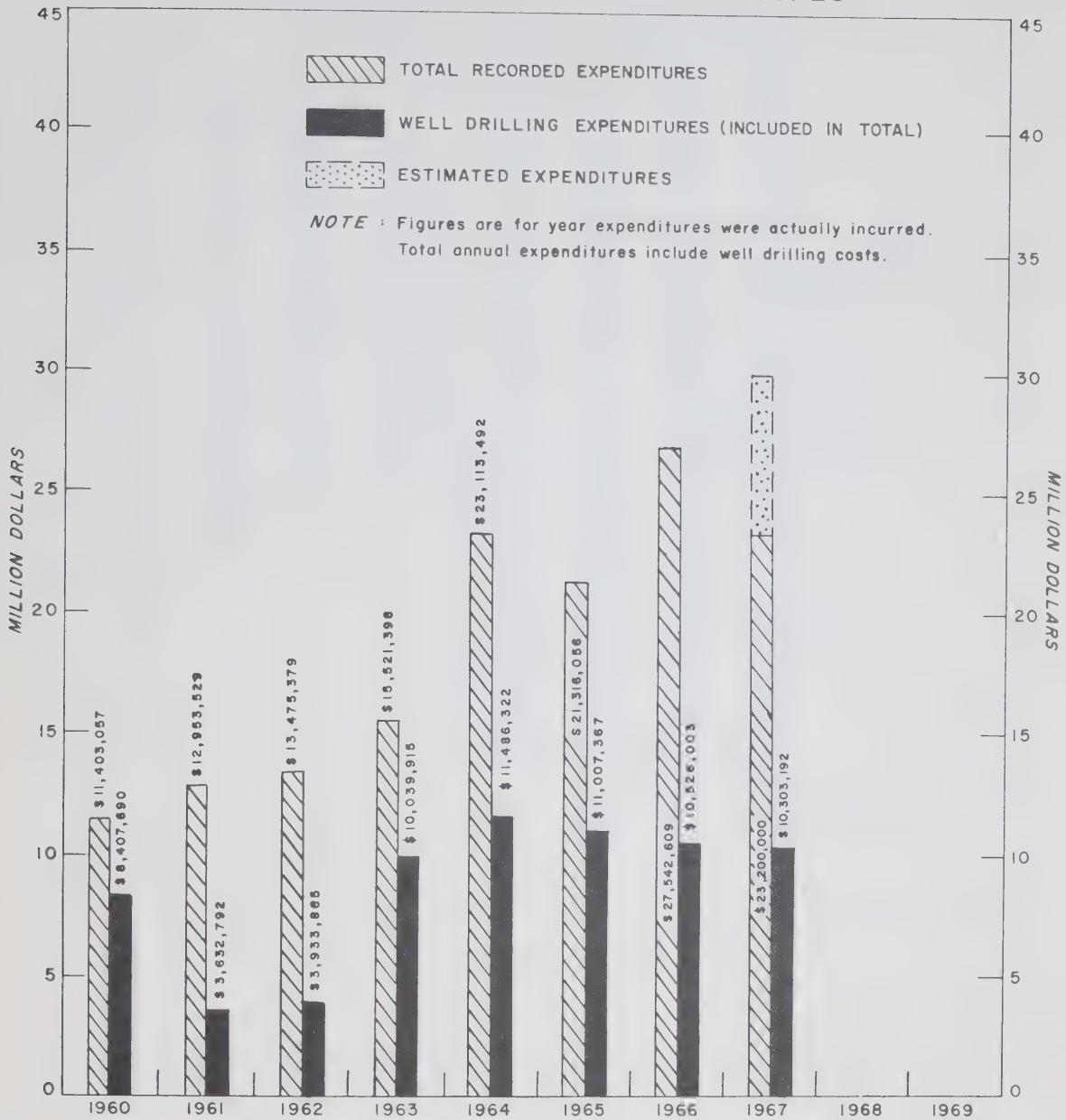


TABLE NO. 3

**NET CASH EXPENDITURES OF THE OIL INDUSTRY
IN THE YUKON & NORTHWEST TERRITORIES**

(in thousands of dollars)

	CALENDAR YEAR		
	1965	1966	1967
1. EXPLORATION —			
(a) Geological & Geophysical Expenditures	8,100	9,000	11,288
(b) Exploratory Drilling —			
Dry	11,000	6,500	6,097
Productive — Oil	2,000	—	—
— Gas / Condensate	100	3,700	4,206
(c) Land Acquisitions and Rentals	1,500	7,800	4,567
(d) Overhead (not included above)	—	—	—
	22,700	27,000	26,158
2. DEVELOPMENT DRILLING —			
(a) Dry	—	—	—
(b) Productive — Oil	—	—	—
— Gas / Condensate	—	—	—
(c) Overhead (Not included above)	—	—	—
3. CAPITAL EXPENDITURES			
(a) Field Equipment — Oil	—	300	100
— Gas / Condensate	—	—	—
(b) Secondary recovery and Pressure maintenance Project	200	—	—
(c) Other	200	300	188
4. OPERATION OF WELLS —			
Including Flow lines and Related Facilities	200	300	376
5. NATURAL GAS PLANTS —			
(a) Capital Expenditures	—	—	—
(b) Operating Expenditures	—	—	—
6. GENERAL —			
(a) Taxes (including income tax)	—	—	—
(b) Royalties	200	200	198
(c) All other Expenses (not allocated in 1 - 5)	—	250	622
TOTAL EXPENDITURES	23,300	28,050	27,643

Fig. 8

FOOTAGE DRILLED
YUKON TERRITORY AND NORTHWEST TERRITORIES

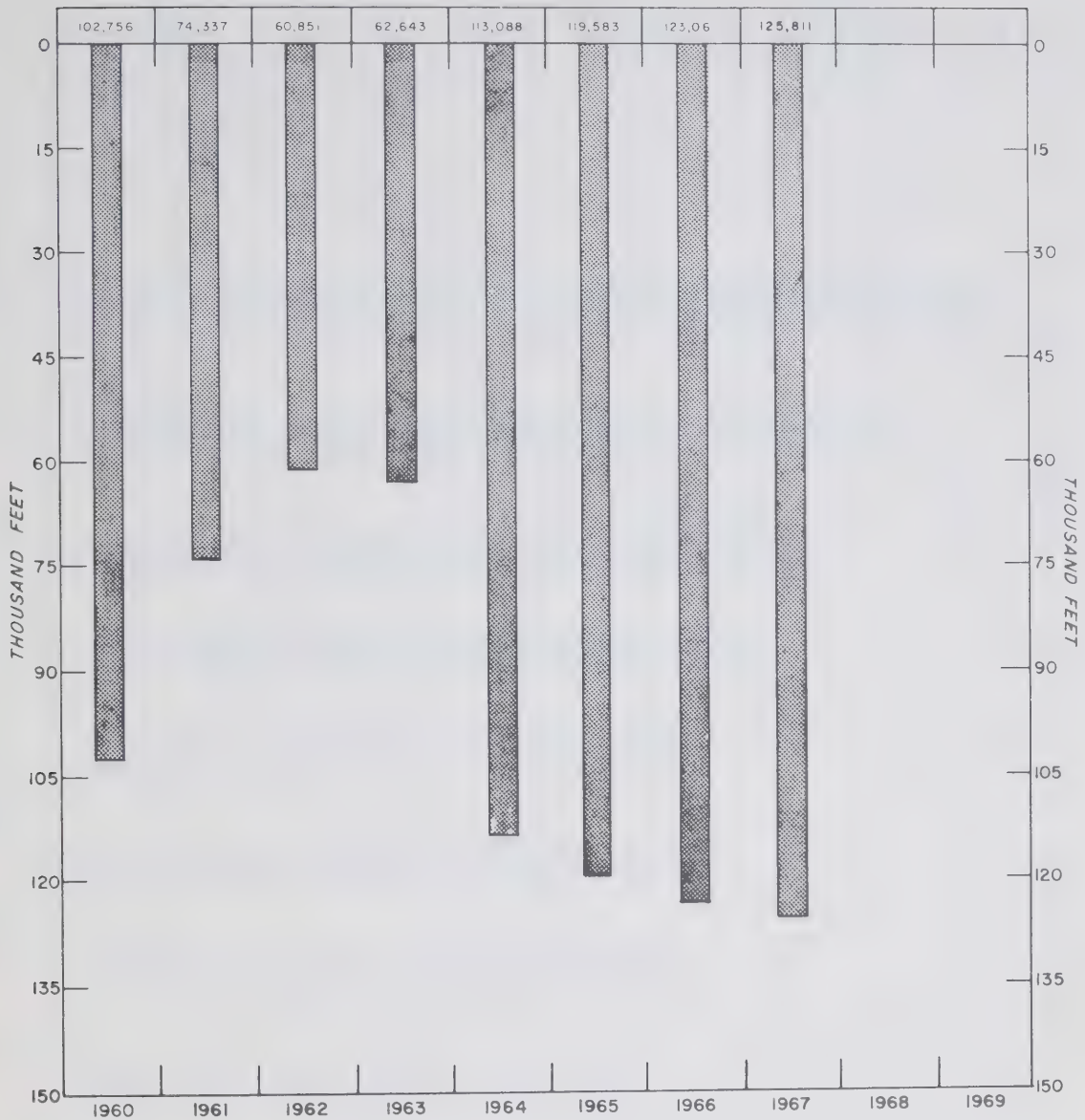
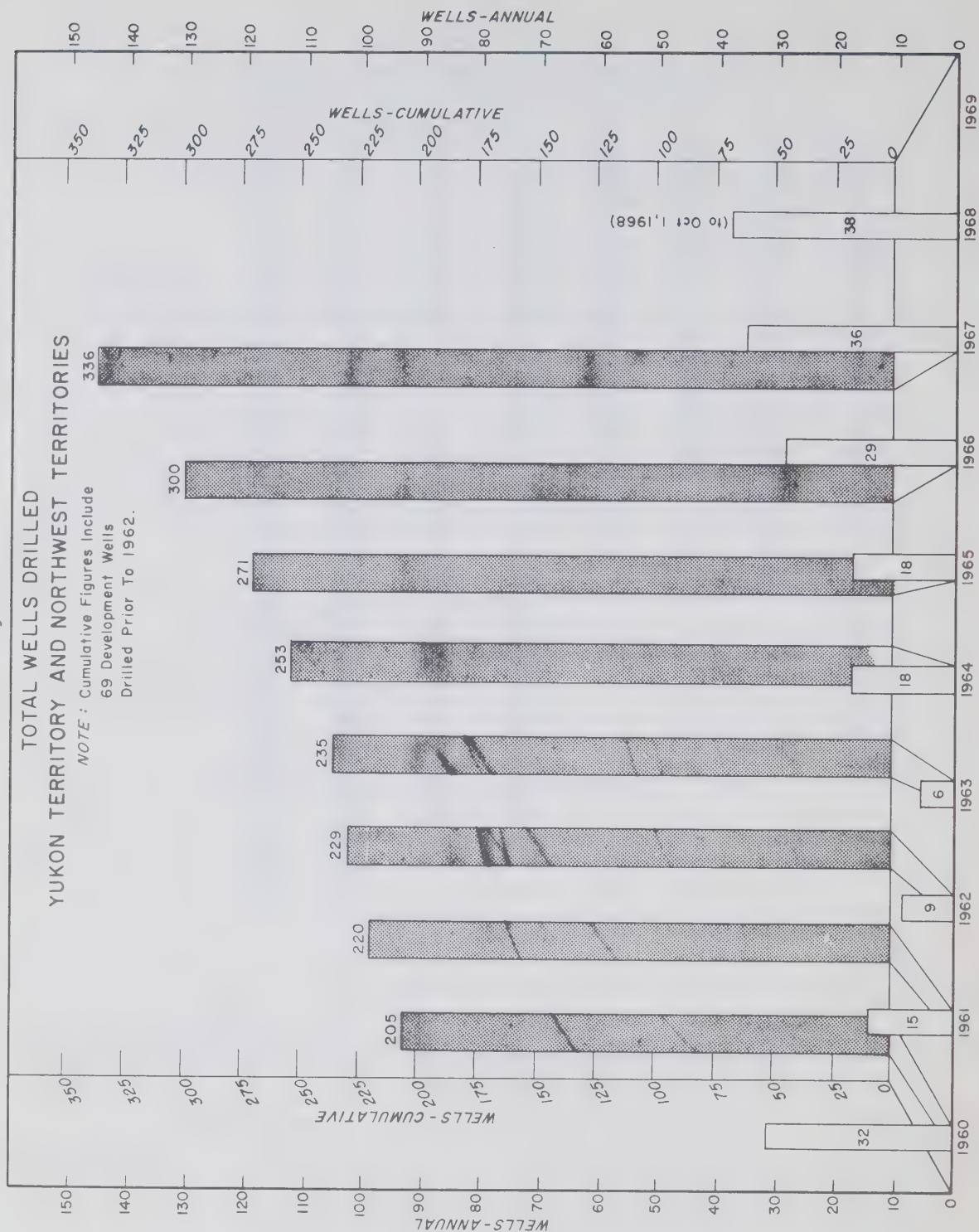
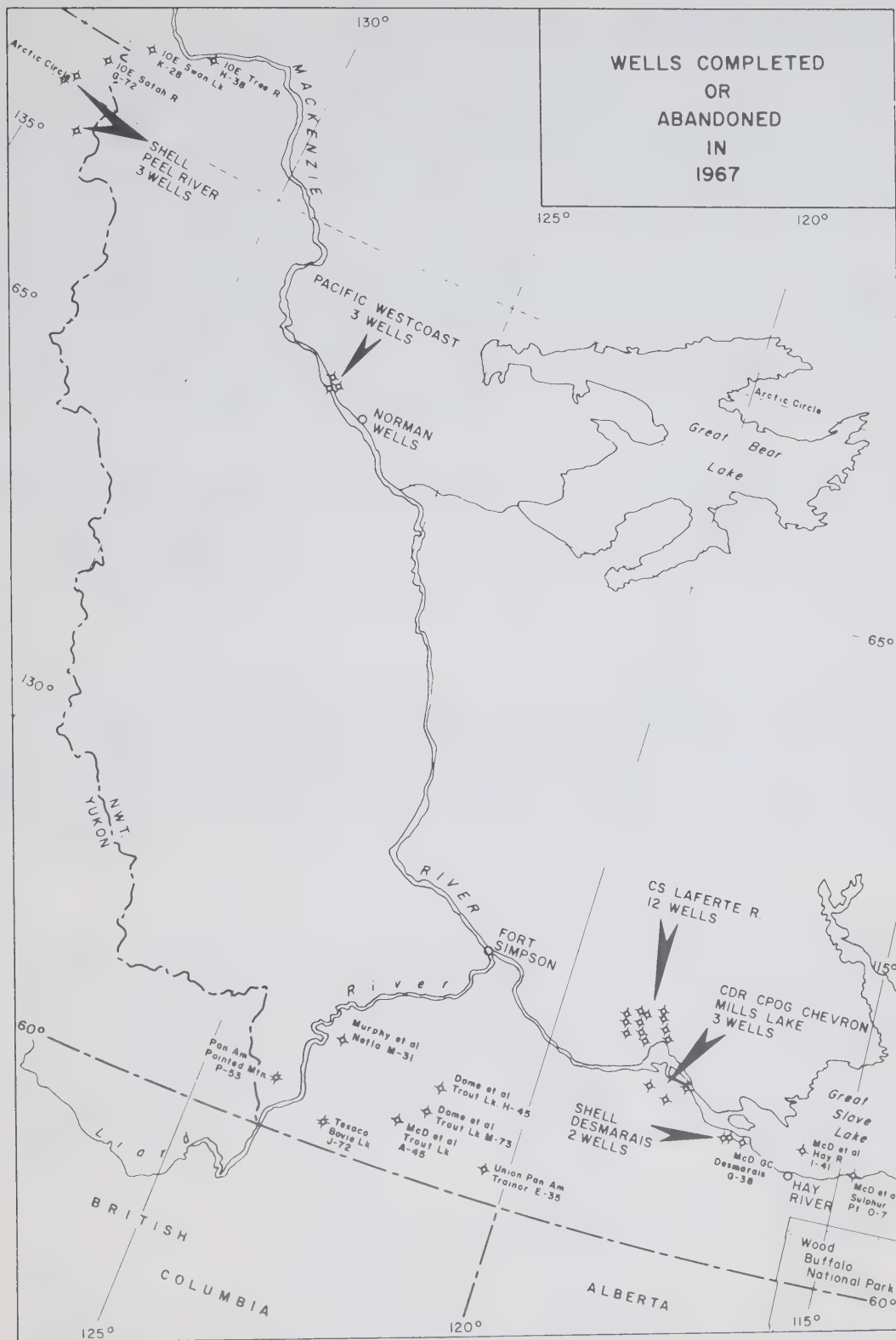


Fig. 9





EXPLORATION HIGHLIGHTS

Panarctic Oils Ltd.

The efforts of the Department and private industry have been brought to fruition in the creation of Panarctic Oils Ltd. The agreements signed by the participating companies and the government on December 12, 1967, have enabled a continuation of pioneer mineral exploration in the Arctic Islands. Panarctic Oils initial financing involves \$20,050,000 of which the Canadian Government will provide \$9,022,500 for a 45 per cent equity and private capital will contribute \$11,027,500 for a 55 per cent equity.

Panarctic Oils Ltd. acquired 44,137,577 acres of oil and gas permits in the Arctic Islands from companies and individuals exceeding 75 in number. The Company has assumed all the work obligations and will carry out a systematic program of exploration. Field exploration commenced in March 1968 when seismograph and gravity meter survey parties were flown to Melville Island. The survey is being carried out on the ground assisted by helicopters. The drilling phase of the program will commence in the spring of 1969.

The initial \$20,050,000 is expected to be expended on exploration over a four year period. In addition to extensive geological and geophysical surveys, the four year program involves the drilling of 17 wells which includes nine deep tests, six medium depth tests and two shallow tests.

Dome Petroleum Limited of Calgary has been appointed interim operator and will manage the exploration program on behalf of the Company.

NORMAN WELLS AGREEMENT

The Canadian Government entered into an agreement with Imperial Oil Ltd. on July 21, 1944. The agreement called for Imperial Oil to develop the oil field at Norman Wells and to sell the oil produced. The Government receives five per cent royalty on 2/3 of oil and gas production which is Imperial's unit interest, less costs of production, refining, marketing and management fee. The initial term of 21 years of the original agreement ended on May 2, 1966. Renewal of the original agreement for a further 21 years has been completed.

OIL AND GAS PRODUCTION AND CONSERVATION ACT

The need for an Oil and Gas Act to provide statutory authority for control of oil and gas production, the prevention of waste, and safety of operations in the north was first recognized by the Department early in 1960. Over the last seven years work on the proposed Act has continued. This has included research into the nature of the matter to be included, obtaining approval of the basic policies to be expressed in the Act, and the holding of relevant discussions with the Canadian Petroleum Association, the Chairman of the National Energy Board and his senior staff, and the Deputy Minister of the then Department of Mines and Technical Surveys and his senior staff. Bill C — "An Act respecting the production and conservation of oil and gas in the Yukon Territory and Northwest Territories" is on the agenda for the 1968-69 session of Parliament.

GAS PURCHASE AGREEMENT — Westcoast Transmission and Pan American Petroleum Corporation

Westcoast Transmission Company and Pan American Petroleum Corporation have negotiated a contract for dedication of Pan American's partially developed gas reserves at Beaver River, three miles south of the Territories, and at Pointed Mountain, in the southwest sector of the Northwest Territories, 20 miles north of the British Columbia border. The contract contains an agreement in respect to construction of a 20 inch

pipeline to extend north for 110 miles from the current terminus at Fort Nelson to the Beaver River area. The reserves proven and those to be developed in the Beaver River-Pointed Mountain area needed to complement reserves required by Westcoast Transmission to guarantee a 25 year life for daily gas delivery to expanding markets, particularly in the northwest region of the United States.

RESERVES

A Crude Oil Reserves

Norman Wells Field

Calculated volumetrically at 419,000,000 barrels of stock tank oil in place.

Since no recovery factor can be substantiated at the present time, recoverable reserves for this field are not given.

B Natural Gas Reserves

No gas reserves are published since all gas discoveries are still in the one-well-field stage.

REFINING OPERATIONS

A Refinery Capacity

1. Imperial Oil Limited

Norman Wells, N.W.T.

1500 barrels per capacity day

1600 barrels per stream day

REVENUES

Sales of oil and gas permit and lease areas are generally held three times a year. The sales take place in the months of January, April and October so that the successful tenders can take advantage of the current season to commence exploratory work. Revenues from these sales, lease and permit fees, royalties, rentals, etc. are shown in Figure No. 10 and Table No. 4. Though "work bonus" tenders (Figure No. 11) are not construed as revenue to the Government, they are listed in this section for reference purposes. The work bonus tender is returned to the permittee upon satisfactory performance of work equal to the amount of the bids.

TABLE NO. 4

OIL AND GAS REVENUES

Year	Yukon	Northwest Territories	Total
1958 - 59	\$ 1,548,315.14	\$ 6,634,330.75	\$ 8,182,645.89
1959 - 60	39,878.18	2,986,104.62	3,025,982.80
1960 - 61	5,915.91	1,836,797.29	1,842,713.20
1961 - 62	176,214.56	1,106,910.42	1,283,124.98
1962 - 63	27,014.80	849,958.88	876,973.68
1963 - 64	413,601.21	774,477.75	1,188,078.96
1964 - 65	25,495.00	852,773.07	878,268.07
1965 - 66	19,749.89	6,252,548.55	6,272,298.44
1966 - 67	92,098.05	1,680,277.49	1,772,375.54
1967 - 68	185,069.82	1,902,349.70	2,087,419.52

Fig. 10

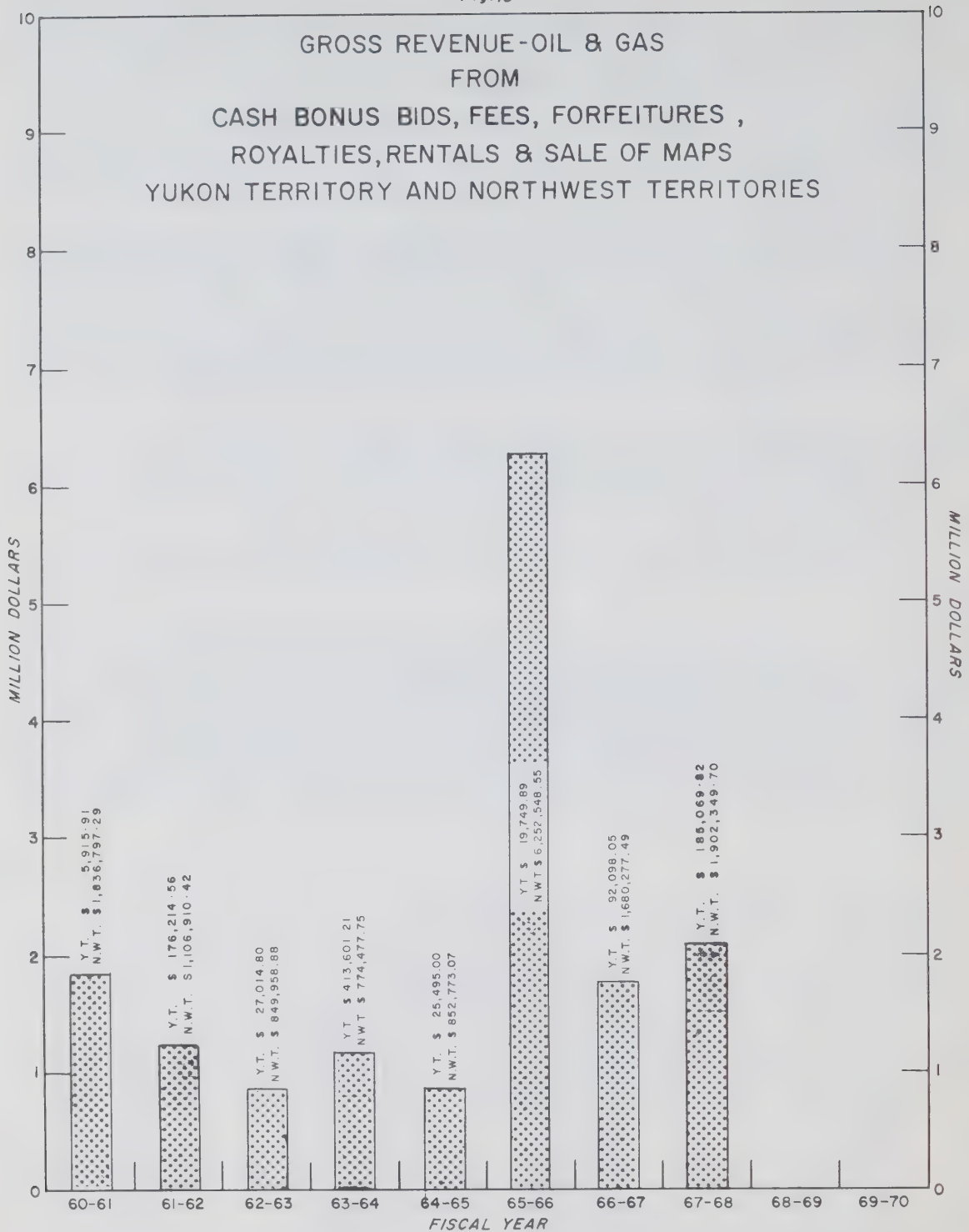


Fig. 11

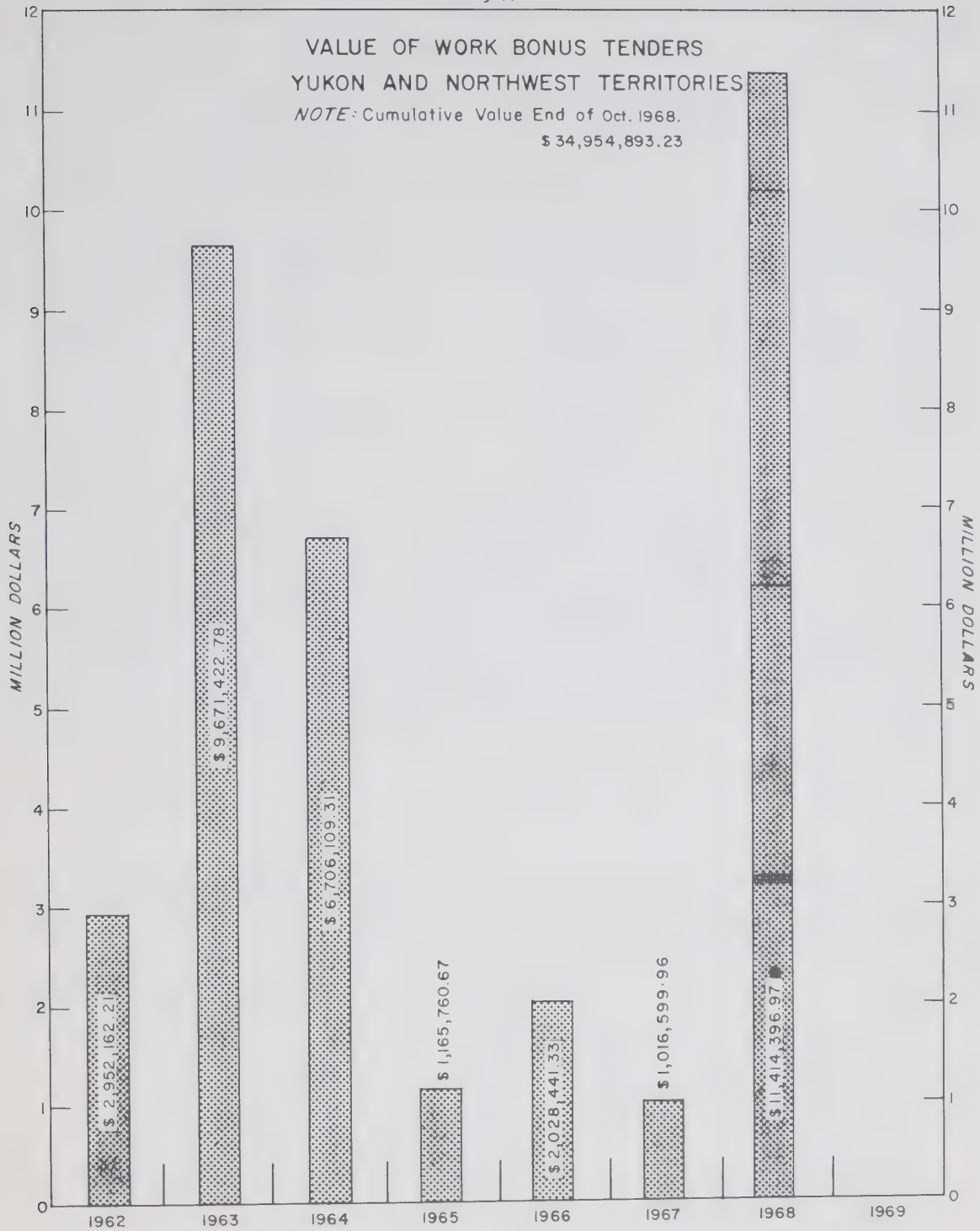


Table NO. 5 shows monies received by the Crown in royalties from the production of crude oil at Norman Wells.

TABLE NO. 5

NORMAN WELLS PRODUCTION AND ROYALTIES

Year	Production	Value of Crude to Refinery	Average Well Head Price / Barrell	Crown Revenues
1958	457,086	856,449.51	1.83	234,001.65
1959	430,319	749,073.00	1.77	234,315.00
1960	468,545	619,257.00	1.37	175,981.00
1961	516,979	652,368.00	1.24	92,768.00
1962	566,168	642,095.00	1.10	133,329.00
1963	630,465	600,901.00	.72	69,882.00
1964	574,125	585,139.00	.98	51,258.00
1965	660,770	665,556.00	1.12	178,878.00
1966	741,476	852,549.00	1.15	213,571.00
1967	684,179	532,633.00	.82	106,229.00

A modest but significant income is received from lease fees, the sale of publications and maps.

FORMS

The Oil and Mineral Division is a member of the "Federal-Provincial Committee on Energy Statistics" and the "Mine Ministers Subcommittee on Oil and Gas Statistics" and together with the four western provinces and the D.B.S. has standardized all its oil and gas reporting forms. This standardization has removed duplication between government agencies and more important, industry can now process all oil and gas reporting forms from the western provinces and the Yukon and Northwest Territories on computer machines without change of programs. A complete list of forms used by industry and issued by this Department is to be found in Appendices Nos. 1 and 2.

PUBLICATIONS

A. Maps

Many maps dealing with the northern resource activities are published by the Division and are available from the Oil Conservation Engineer, Calgary, Alberta, or from the Chief, Oil and Mineral Division, Ottawa. See the Oil and Mineral Division's list of "available maps".

B. Reports (Available from the Queen's Printer and The Oil Conservation Engineer Calgary, Prepayment is required.)

Schedule of Wells 1920 - 1960	— \$3.00
Schedule of Wells 1920 - 1961	— 4.00
Schedule of Wells 1920 - 1963	— 4.00
Schedule of Wells 1962 - 1964	— 2.00
Schedule of Wells 1965	— 3.00
Schedule of Wells 1966	— 3.00
Schedule of Wells 1967	— 2.50
Oil and Gas Statistical Report No. 1 (1920 - 1960)	— 2.50
Oil and Gas Statistical Report No. 2 (1961 - 1965)	— (in preparation)
Economics of Oil and Gas Development in Northern Canada	— 2.50

C. Brochures (available from the Chief, Oil and Mineral Division)

- (a) Guide to Northern Non-Renewable Resources*
- (b) Communication and Transportation Facilities Queen Elizabeth Group – Arctic Islands*
- (c) Resource Management Division – Responsibilities and Administration*
- (d) Oil and Gas Canada Lands – Volume No. 2*
- (e) Oil and Gas Canada Lands – Edition No. 3*
- (f) Technical Reports Available for Inspection 1967 (Released geological and geophysical reports on Canada Lands submitted by oil operators; Reports for inspection are available only in Calgary, office of Oil Conservation Engineer).
- (g) Minutes of meetings, C.P.A. – Federal Government Representatives “On Problems Relating to Offshore Areas.”*

*Out of print but available in some libraries

SOURCES OF INFORMATION

Information on northern resources activities can be obtained from the Chief, Oil and Mineral Division, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa. All cores and samples from wells drilled on Canada lands are stored at the Institute of Petroleum and Sedimentary Geology, 3303 – 33rd St., N.W. Calgary, Alberta. Specialized and technical literature pertaining to Northern Canada can be purchased or perused at the following government agencies:

- (a) Northern Co-ordination and Research Centre, or Library, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa, Ontario.
- (b) Department of Energy, Mines & Resources
 - 1. Geological Survey of Canada – Ottawa, Ontario. Vancouver, B.C.
Institute of Petroleum and Sedimentary Geology – Calgary, Alberta.
 - 2. Geographical Branch – Ottawa, Ontario.
 - 3. Dominion Observatories Branch – Ottawa, Ontario.
 - 4. Marine Sciences Branch Bedford Oceanographic Institute – Dartmouth, N.S.
 - 5. Surveys and Mapping Branch – Ottawa, Ontario.
- (c) Defence Research Board Scientific Information Service
- (d) Department of Transport
 - 1. Marine Works Branch – Ottawa, Ontario.
 - 2. Marine Operations Branch – Ottawa, Ontario.
 - 3. Telecommunications and Electronics Branch – Edmonton, Alberta Ottawa, Ontario.
 - 4. Civil Aviation Branch – Winnipeg, Manitoba.
 - 5. Meteorological Branch – Toronto, Ontario.
- (e) Arctic Institute of North America – Montreal, Quebec.
- (f) National Research Council – Ottawa, Ontario

REQUIREMENTS AND SERVICES OF FEDERAL AGENCIES WHEN CONDUCTING EXPLORATION

In January, 1965, a meeting was held between industry and governmental representatives in order to outline: the requirements of various federal agencies, the services available through these agencies, and the persons to contact, concerning oil and gas exploratory operations in Northern Canada and Offshore. The Minutes of the Meeting were subsequently published and widely distributed. The following comments will serve to update the Minutes.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

1. Pursuant to Section 52 "Notice of Commencement of Exploratory Work" must be filed 15 days prior to commencement of proposed programs on the mainland and Arctic Islands, and 45 days prior to commencement of exploratory work on offshore areas with the,

Oil Conservation Engineer,
Oil and Mineral Division,
3303 — 33rd St. N.W.,
Calgary, Alberta Phone 403-284-2201

2. For information concerning wildlife sanctuaries and related matters contact:

Executive Director,
Canadian Wildlife Service,
Dept. of Indian Affairs and Northern Development,
Ottawa, Ontario. Phone 613-992-3229

Attention: Dr. F.G. Couch

DEPARTMENT OF FISHERIES

Resource Development Service

Ninety days notice in advance is required before the start of marine seismic surveys, in case a qualified observer may be warranted. Notification should be sent to the Regional Director with a copy to:

Director
Resource Development Service,
Department of Fisheries,
Ottawa, Ontario. Phone: 997-4044

Attention: K.C. Lucas

Information regarding the Department's requirements can also be obtained from:

Assistant Director,
Resource Development Service. Phone: 997-4526

Attention: Mr. E.W. Burrige

The address of the Regional Director responsible for all fresh water lakes in the Northwest Territories and Yukon is:

R.N. Gordon,
114 Gary Street,
Winnipeg 1, Manitoba. Phone: 204-946-8101

DEPARTMENT OF TRANSPORT

1. Aids to Navigation Division

This agency administers the Navigable Waters Protection Act, Parts I & II, and such requires at least two months notice in advance of commencing work on offshore areas. Communications should be directed to:

Chief,
Aids to Navigation Division,
Department of Transport,
Ottawa, Ontario. Phone: 992-2736

Attention: Mr. J. N. Ballinger

2. Meteorological Branch

Data regarding weather and ice conditions, some obtained from orbiting satellites, are compiled by the Branch and are available to exploration companies. Information concerning these and other relevant matters can be obtained through:

Liaison Meteorologist,
Department of Transport,
No. 3 Temporary Building,
Ottawa, Ontario. Phone: 992-4217

Attention: Mr. E. Barclay

Information on Arctic weather stations can also be acquired from:

Meteorological Branch
Department of Transport,
Mackenzie King Building,
Toronto, Ontario. Phone: 416-362-6211

Attention: Mr. C. Goodbrand

3. Radio Regulations Divisions

Details of the requirements and services of this agency are available through:

Controller,
Radio Regulations Division,
Department of Transport,
Ottawa, Ontario. Phone: 992-0840

Attention: Mr. W. A. Caton

or through:

Supertintendent of Radio Authorization and Enforcement,
Radio Regulations Division. Phone: 992-3427

Attention: Mr. A.G.E. Argue

DEPARTMENT OF NATIONAL REVENUE CUSTOMS AND EXCISE DIVISION

All communications with respect to this agency should be addressed to:

Director,
Customs and Excise Division,
Port Administration Branch,
Department of National Revenue,
Ottawa, Ontario. Phone: 992-2742

Attention: Commercial Operations Section

DEPARTMENT OF MANPOWER AND IMMIGRATION

Enquiries should be directed to:

Department of Manpower and Immigration,
Canada Immigration Division,
Admission Section,
Ottawa, Ontario. Phone: 992-3305

The Calgary office of the Department of Immigration can answer any queries regarding entry into the Northwest Territories. The Vancouver office is responsible for entry into the Yukon Territory.

At Tuktoyaktuk, a local R.C.M.P. officer is also a representative of the Department of Manpower and Immigration and can clear entry into Canada via Tuk.

At Inuvik, the Customs Department has a Departmental representative and he can be contacted by telephone if prior arrangements are necessary. There is no representative at Aklavik; if you foresee that a seismic crew will prefer to land at Aklavik, then arrangements must be made with the Inuvik representative.

DEPARTMENT OF NATIONAL DEFENSE

When conducting operations off-shore Pacific or Western Arctic, please contact:

The Flag Officer,
Maritime Commander (Pacific),
Victoria, British Columbia,

General enquiries can be directed to:

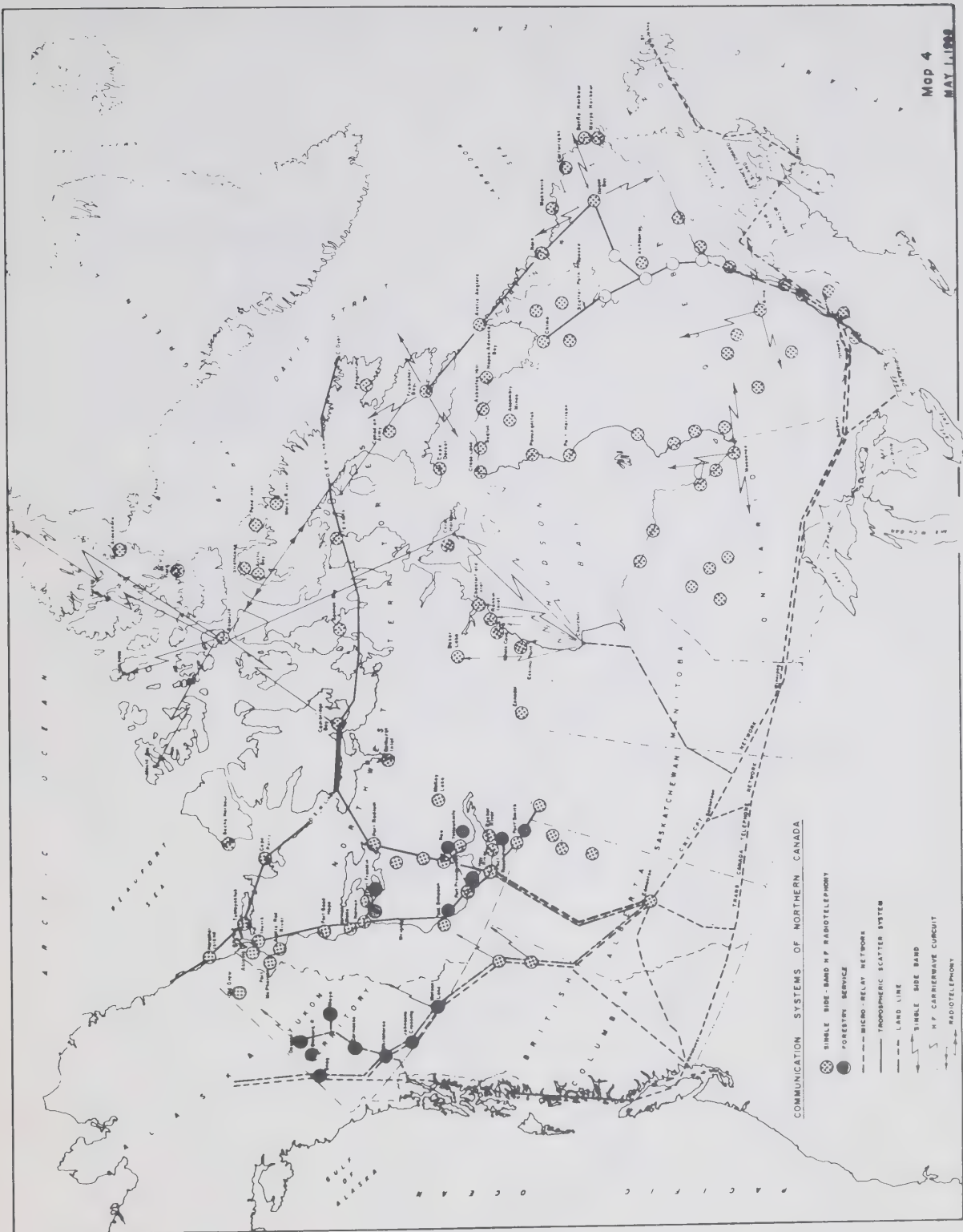
Chief of Defense Staff.
Phone: 992-4248

Attention: Directorate of Operations, Ottawa, Ontario.

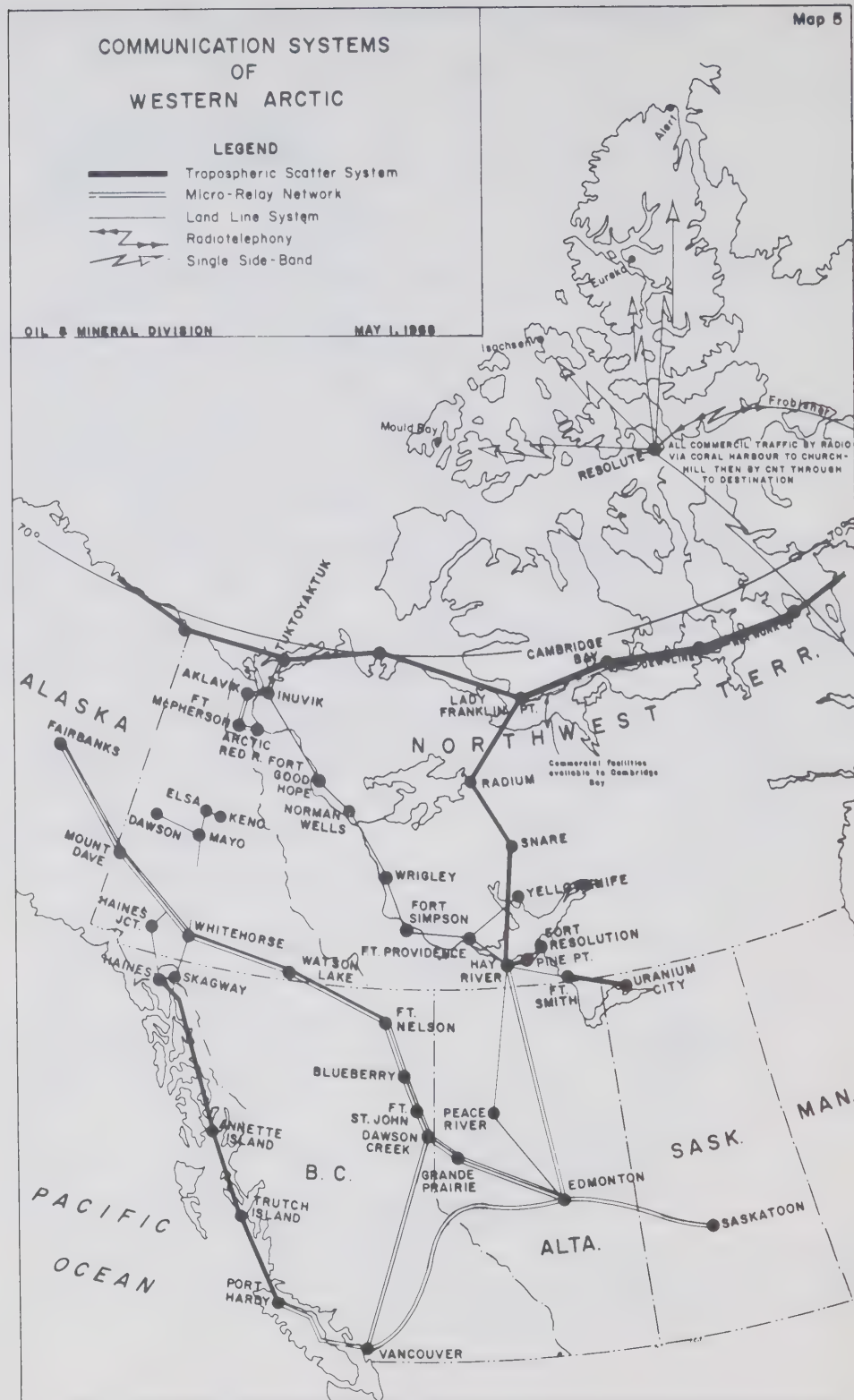
COMMUNICATIONS

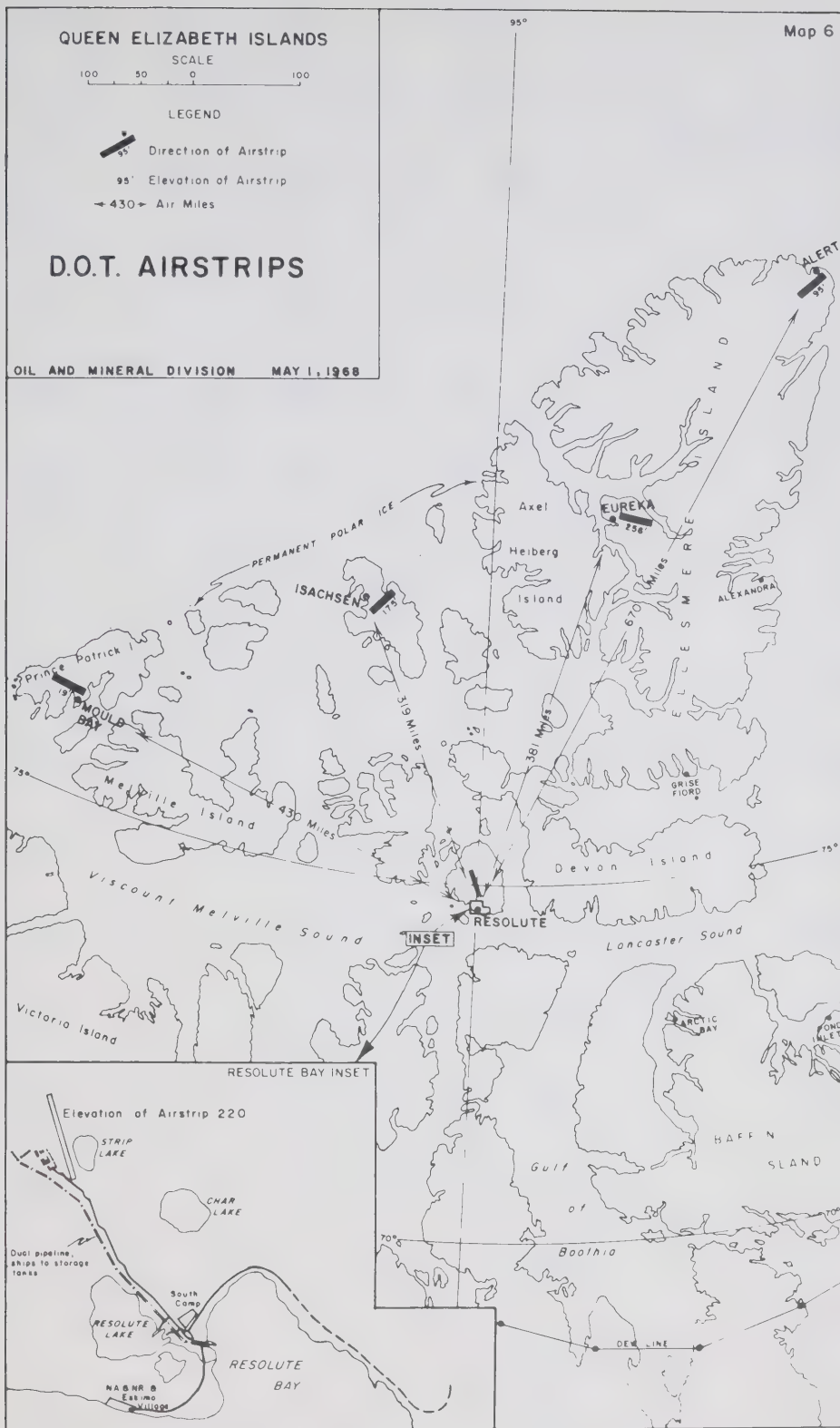
The brochure, "Communications and Transportation Facilities, Queen Elizabeth Group, Arctic Islands", contains a detailed summary of communication and transportation facilities in the Arctic Islands. Please refer to it also for all basic information on accommodation at Resolute and the satellite weather stations.

Voice communication facilities are available from southern Canada to Resolute via Frobisher Bay. Maps Nos. 4, 5, and 6 contain relevant data on trunk lines and communications systems of northern Canada.



MOD 4
MAY 1, 1992





APPENDIX I

WELLS COMPLETED OR ABANDONED IN 1967

NORTHWEST TERRITORIES

NAME OF WELL	SPUDDED	COMPLETED	STATUS	TOTAL DEPTH
CDR CPOG Chevron Mills Lake I-57	29-1-67	22-2-67	D & A	1,932
CDR CPOG Chevron Mills Lake A-70	23-2-67	17-3-67	"	2,412
CDR CPOG Chevron Mills Lake J-74	19-3-67	3-4-67	"	2,287
CS Laferte River G-71	8-1-67	23-1-67	"	1,428
CS Laferte River C-25	8-1-67	23-1-67	"	1,600
CS Laferte River I-47	24-1-67	9-2-67	"	1,511
CS Laferte River M-39	23-1-67	4-2-67	"	1,423
CS Laferte River M-16	5-2-67	21-2-67	"	1,681
CS Laferte River G-41	10-2-67	26-2-67	"	1,651
CS Laferte River O-15	22-2-67	15-3-67	"	1,951
CS Laferte River A-50	26-2-67	11-3-67	"	1,867
CS Laferte River H-27	13-3-67	23-3-67	"	1,708
CS Laferte River D-73	15-3-67	25-3-67	"	1,822
CS Laferte River A-66	23-3-67	8-4-67	"	1,870
CS Laferte River N-54	26-3-67	6-4-67	"	1,780

NAME OF WELL	SPUFF			
NAME OF WELL	SPUDD	COMPLETED	STATUS	TOTAL DEPTH
Dome et al Trout Lake M-73	5-1-67	30-1-67	D & A	6,427
Dome et al Trout Lake H-45	16-2-67	6-3-67	"	5,584
IOE Swan Lake K-28	31-1-67	2-3-67	"	6,033
IOE Tree River H-38	19-3-67	23-4-67	"	4,197
McD et al Trout Lake A-45	7-2-67	1-3-67	"	7,571
McD et al Hay River No. 1 I-41	2-3-67	30-3-67	"	837
McD et al Sulphur Point No. 1 O-7	2-4-67	12-4-67	"	440
McD et al Desmarais No. 1 G-38	30-3-67	10-4-67	"	1,803
Murphy et al Netla M-31	26-2-67	2-4-67	"	5,565
Pan Am Pointed Mountain P-53	8-2-66	22-2-67	Suspended Gas Well	14,339 T.D. 13,570 P.B.D.
Pacific Westcoast Oscar Creek H-77	20-7-67	8-8-67	D & A	2,010
Pacific Westcoast Judile O-41	9-8-67	20-8-67	"	1,415
Pacific Westcoast Judile O-17	24-8-67	11-9-67	"	1,890
Shell Desmarais J-48	26-11-67	7-12-67	"	2,058
Shell Desmarais K-29	9-12-67	19-12-67	"	1,791
Texaco Bovie Lake J-72	6-2-67	7-3-67	Suspended Gas Well	11,034 T.D. 9,855 P.B.D.

NAME OF WELL	SPUDDED	COMPLETED	STATUS	TOTAL DEPTH
YUKON TERRITORY				
Union Pan Am Trainor E-35	20-12-66	30-1-67	D & A	7,290
IOE Satah River Y.T. G-72	13-1-67	9-3-67	D & A	7,500
Shell Peel River Y.T. B-6A	3-1-67	25-1-67	"	3,500
Shell Peel River Y.T. K-9	6-2-67	7-3-67	"	5,100
Shell Peel River Y.T. H-59	11-3-67	1-4-67	"	2,504

APPENDIX II

The following forms have been issued pursuant to the “Canada Oil and Gas Land Regulations” and the “Canada Oil and Gas Drilling and Production Regulations”. These forms are to be completed when applicable during the exploratory stages, and prior to production of oil and gas.

FORM NO.	TITLE OF FORMS
IAN 52-90	Front Covers for Well File
IAN 52-90	Back Covers for Well File
IAN* 52-90-1**	Application for a Drilling Authority
IAN* 52-90-2	Well Completion Data
IAN* 52-90-3**	Application to Amend a Drilling Authority
IAN* 52-90-4**	Application to Change a Well Name
IAN* 52-90-5**	Application to Abandon a Well or Suspend Drilling
IAN* 52-90-6**	Application to Alter Condition of a Well
IAN* 52-90-7	Work-over Report No.
IAN* 52-90-8	Application to Commingle Production before Measurement
IAN* 52-90-9	Data for Back Pressure Test on Natural Gas Wells – Monograph 7 Method
IAN* 52-90-10	Data for Back Pressure Test on Natural Gas Wells – Vitter’s Method
IAN* 52-90-11	M.P.R. – Oil – Calculations
IAN* 52-90-12	New Oil Well Report
IAN* 52-90-13	New Gas Well Report
IAN 52-90-14	Well-Site Inspection Report (in pads of 25)
IAN 52-90-15	Rig Inspection Report (in pads of 25)
IAN 52-90-16	Gas Well Installation/Battery Inspection Report (in pads of 25)
IAN* 52-90-17	New Service Well Report
IAN* 52-90-18	Monthly Water Flood Operations Report
IAN 52-90-19	Well Card
IAN* 52-90-20	Monthly Water Receipts and Disposal of Fluid Report
IAN 52-90-21	Meter Inspection Report (in pads of 25)
IAN 52-90-22	Monthly Operations Report (in pads of 25)
IAN* 52-91	Notice of Commencement of Exploratory Work
IAN* 52-92	Application for Authority to Drill Structure Test Holes
IAN* 52-93	Report on Abandonment of Structure Test Holes
IAN* 52-83	Grouping Notice
IAN* 52-103**	Application for Oil and Gas Lease

* To be completed by Operator

** To be completed in triplicate; all other forms to be completed in duplicate.

All forms except IAN 52-83 and 52-103 to be submitted to the Oil Conservation Engineer, 3303-33rd St. N.W., Calgary, Alberta.

Forms IAN 52-83 and 52-103 to be submitted to the Oil and Mineral Division, 400 Laurier Avenue West, Ottawa 4, Ontario.

APPENDIX III

The following forms have been issued pursuant to the "Canada Oil and Gas Land Regulations" and the "Canada Oil and Gas Drilling and Production Regulations". These forms are to be completed when applicable during the production stage of oil and gas wells, and refinery operations.

FORM NO.	TITLE OF FORM
IAND 52-116-1	Monthly Production Report
IAND 52-116-2	Monthly Disposition and Crown Royalty Statement
IAND 52-116-3	Monthly Gas Gathering Statement
DBS 6511-38*	Monthly Oil Pipeline Gathering Operations Statement
IAND 52-116-5	Monthly Crude Oil and Condensate Purchasers' Statement
IAND 52-116-6	Monthly Gas Plant Statement
DBS 6511-37*	Monthly Natural Gas Distributors Statement
IAND 52-116-8	Monthly Gas Processing Plant Products Statement
IAND 52-116-9	Monthly Liquefied Petroleum Gas Purchasers Statement
IAND 52-116-10	Monthly Refinery Operations Report
IAND 52-116-11	Monthly Gas Injection Operations Report
IAND 52-116-12	Statement of Nomination and Estimated Requirement for Crude Oil, Condensate and Pentanes Plus

- NOTE:**
- (a) All forms to be completed by Operator.
 - (b) Please complete three copies of Forms 6511-31 and 6511-38. Submit original and one copy to Oil and Mineral Division and one copy to Oil Conservation Engineer, Department of Indian Affairs and Northern Development, Calgary, Alberta. One copy is submitted to Dominion Bureau of Statistics by Oil and Mineral Division.
 - (c) Please complete 2 copies of all other forms; submit original to Oil and Mineral Division, Ottawa, and one copy to the Oil Conservation Engineer, Department of Indian Affairs and Northern Development, Calgary, Alberta.

APPENDIX IV

Selected geological references applicable to the following geological provinces. References are Geological Survey of Canada publications unless otherwise noted.

INTERIOR PLAINS

Memoir 273	The Lower Mackenzie River Area G.S. Hume
Memoir 322	Stratigraphy of Middle Devonian and Older Palaeozoic Rocks of the Great Slave Lake Region, Northwest Territories A.W. Norris
Bulletin 95	Carboniferous and Permian Rocks, Southwestern District of Mackenzie P. Harker
Paper 58-2	Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains J.A. Jeletzky
Paper 58-11	Great Slave and Trout River Map Areas R.J.W. Douglas
Paper 59-11	Horn River Map Area R.J.W. Douglas, et al
Paper 61-1	Summary Account of Carboniferous and Permian Formations – Southwestern District of Mackenzie P. Harker
Paper 61-9	Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell Rivers J.A. Jeletzky
Paper 61-13	Camsell Bend and Root River Map Areas R.J.W. Douglas, et al
Paper 61-81	Geological Notes – Northern District of Keewatin W.W. Heywood

- | | |
|-------------|--|
| Paper 61-29 | Upper Devonian Formations |
| | H.R. Belyea, et al |
| Paper 62-15 | Middle Devenian and Older Paleozoic Formations of Southern District of Mackenzie |
| | H.R. Belyea, et al |
| Paper 62-33 | Dahadinni and Wrigley Map Areas |
| | R.J.W. Douglas, et al |

ARCTIC LOWLANDS

- | | |
|-------------|---|
| Paper 63-44 | Surficial Geology of Boothia Peninsula and Somerset, King William and Prince of Wales Islands |
| | B.G. Craig |
| Paper 64-47 | Lower Palaeozoic Sediments of Northwestern Baffin Island |
| | H.P. Trettin |

FRANKLINIAN GEOSYNCLINE

- | | |
|--|---|
| Memoir 294 | Cornwallis and Little Cornwallis Islands – District of Franklin, Northwest Territories |
| | R. Thorsteinsson |
| Memoir 309 | Permian Rocks and Faunas of Grinnell Peninsula – Arctic Archipelago |
| | P. Harker, et al |
| Memoir 316 | Triassic Stratigraphy and Faunas, Queen Elizabeth Islands, Arctic Archipelago |
| | E.T. Tozer |
| Memoir 330 | Banks, Victoria and Stefansson Islands, Arctic Archipelago |
| | R. Thorsteinsson & E.T. Tozer |
| Bulletin Canadian Petroleum Geology Vol. 15, No. 1 | |
| | New Nomenclature for Ordovician Rock Units of the Eastern and Southern Queen Elizabeth Islands, Arctic Canada |
| | Wm. Kerr |

Middle Ordovician to Middle Silurian Carbonate Cycle, Brodeur Peninsula,
Northwestern Baffin Island

H.P. Trettin

SVERDRUP BASIN

Memoir 320 Geology of the North Central Part of the Arctic Archipelago — (Operation
Franklin)

Y.O. Fortier, et al

Memoir 331 Geological Reconnaissance of Northeastern Ellesmere Island — District of
Franklin

R.L. Christie

Memoir 332 Western Queen Elizabeth Islands, Arctic Archipelago

E.T. Tozer & R. Thorsteinsson

Page 60-7 Summary Account of Structural History of the Canadian Arctic Archipelago
since Precambrian Time

R. Thorsteinsson, et al

Paper 63-30 Mesozoic and Tertiary Stratigraphy, Western Ellesmere Island and Axel
Heiberg Island

E.T. Tozer

Page 66-34 Lower Triassic Tar Sands of Northwestern Melville Island, Arctic Archipelago

H.P. Trettin, et al

Paper 66-55 Ordovician Stratigraphic Section at Daly River, Northeast Ellesmere Island

B.S. Norford

Paper 67-27 Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada. Protero-
zoic and Cambrian

J. Wm. Kerr

Paper 67-27 pt II (in press)

Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada pt II.
Ordovician

J. Wm. Kerr

Paper 67-27 pt III (in press)

Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada pt. II.
Upper Ordovician, Silurian and Devonian

J. Wm. Kerr

G.S.C. Bulletin (in press)

Pre-Mississippian Rocks of Northern Axel Heiberg and Northwestern Ellesmere
Island, Arctic Archipelago

H.P. Trettin

FOXES BASIN

Paper 62-35

Notes with Map 3-1958 and Map 4-1958 – Fury and Hecla Strait; Foxe
Basin North

R.G. Blackadar

Geog. Bull.4

The Islands in Foxe Basin; Geog. Br. Department of Mines and Technical
Surveys

PP. 1-29

Paper 64-47

Lower Palaeozoic Sediments of Northwestern Baffin Island, District of
Franklin

H.P. Trettin

HUDSON BAY BASIN AND LOWLANDS

Paper 48-23

Flights over the North Magnetic Pole, the Mainland between the Arctic
Coast, Great Slave Lake and Hudson Bay

Y.O. Fortier

Paper 59-13

Aeromagnetic Surveys Across Hudson Bay from Churchill to Coral Harbour
and Churchill to Great Whale River

M.E. Bower

Paper 60-20

Belcher Islands

G.D. Jackson

Paper 63-48

Sedimentology of Hudson Bay

R.J. Leslie

ARCTIC COASTAL PLAINS AND CONTINENTAL SHELF

Paper 63-22 Marine, Geology, Eastern Part of Prince Gustaf Adolf Sea

J.L. Marlowe, et al

EAGLE PLAIN & NORTHERN YUKON

Memoir 247 Physiography of the Canadian Cordillera with Special Reference to the Area
North of the Fifty-fifth Parallel

H.S. Bostock

Paper 61-9 Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson
Mountains between the Headwaters of Blow and Bell Rivers

J.A. Jeletzky

Paper 63-39 Reconnaissance of the Ordovician and Silurian Rocks of Northern Yukon
Territory

B.S. Norford

Paper 66-39 Descriptions of Devonian Sections in Northern Yukon and Northwestern
District of Mackenzie

A.W. Norris

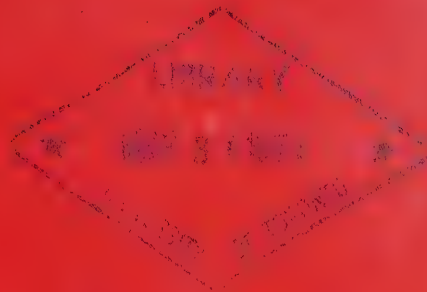
activities

1968



**north
of 60**

oil and gas



northern economic
development branch
department of indian affairs
and northern development
government of canada

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OIL AND GAS, NORTH OF 60

**A report of Activities in 1968, of the
Oil and Gas Industry
In the Yukon Territory and Northwest Territories**

1968

(Edition No. 5)

Compiled By
Oil and Gas Section
Oil and Mineral Division
Northern Economic Development Branch

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

Issued under the Authority of the
Honourable Jean Chrétien, P.C., M.P., B.A., LL.L.
Minister of Indian Affairs and Northern Development
Ottawa, Canada

January 1, 1969

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The Queen's Printer
Ottawa, 1969

Cat. No.: R71-6/1968

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INTRODUCTION

Canada north of 60 is poised for major developments in oil and gas exploration. The pace is accelerating every year as oil companies, encouraged by oil discoveries in northern Alberta and on the Alaska North Slope, converge on large untested sedimentary basins in the Territories and Arctic Islands.

Oil and Gas Permits in effect in the north as of December 31, 1968, covered approximately 324 million acres as follows: 96 million acres on the Northwest Territories mainland; 26 million in the Yukon, 188 million in the Arctic Islands and over 10 million acres offshore along the Arctic Coast. Oil and Gas Leases in effect in the north as of December 31, 1968 covered over 2 million acres; approximately 2 million in the Northwest Territories mainland and 186 thousand in the Yukon.

Figure No. 1 graphically illustrates the total acreage held under oil and gas permits during the last seventeen years.

Map No. 1 illustrates the extent of Canada lands under permit and lease north of 60.

Expenditures for oil and gas exploration in 1968 are in the order of 30 million dollars. Approximately 2/3 of this was spent on geophysical exploration.

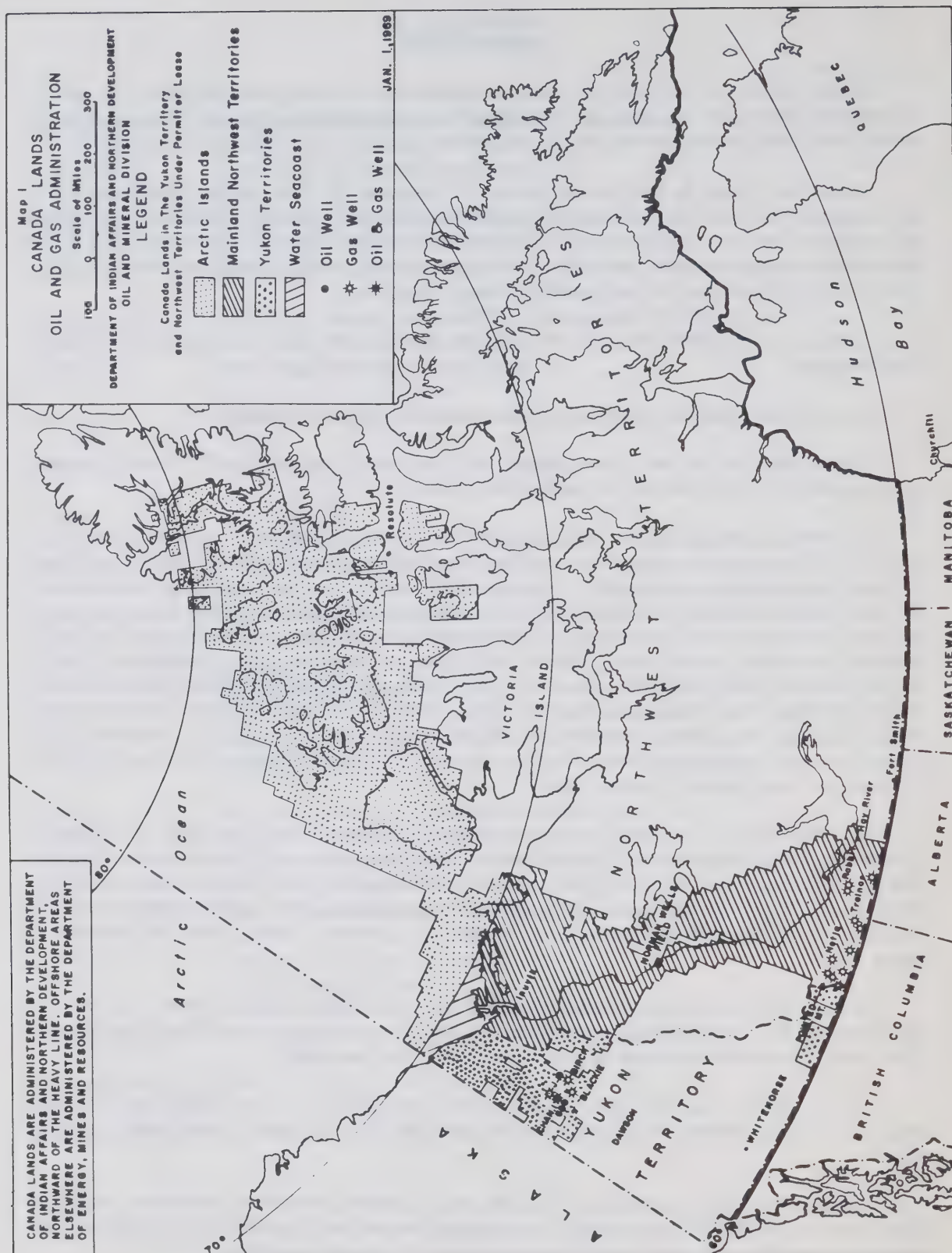
How much oil and gas will be found north of 60 is, of course, unknown. In Canada north of 60, about 450,000 square miles are underlain by sedimentary rocks ranging in age from Cambrian to Tertiary that may be considered to be potentially productive of oil and gas. Map No. 2 outlines the areal extent of the major geologic provinces of Canada's North. Excluding all sediments in areas where the total section is less than 1,000 feet thick as well as those at depths exceeding 16,000 feet, at present believed to be only marginally attractive, there are nearly 100,000 cubic miles of sedimentary rocks. Applying a factor of 50,000 barrels of oil and 300 million cubic feet of gas per cubic mile of sediment, the average established in the United States where many basins have been subject to rather complete exploration, possible reserves north of 60 may be 50 billion barrels of oil and 300 trillion cubic feet of gas. A comparison of the sedimentary areas, volumes and proven oil and gas reserves in the Western Provinces, the Yukon, Northwest Territories and Arctic Islands is given in Table 1.

From the standpoint of oil and gas, Canada north of 60 is virtually unexplored. Since 1947, generally considered to be the beginning of the modern era for oil and gas exploration in Western Canada, there has been one exploratory well drilled for 1,800 square miles of sedimentary area on the mainland north of 60. In the Arctic Islands, the exploratory drilling density is one well for every 100,000 square miles. This contrasts with the Western Provinces where the density of exploratory drilling is one well for every 40 square miles.

Norman Wells is the only producing oil field north of the 60th parallel in Canada. The field was discovered in 1920, but intensive commercial development did not take place until World War II. During 1968, oil was produced at an average rate of approximately 2,364 barrels daily.

Several significant gas flows and a few good oil shows have been encountered in other areas, but these finds have not been commercially exploited as yet, due to lack of suitable market outlets within economic reach.

Canada north of 60 encompasses one of the largest remaining unexplored sedimentary geological provinces in the world. With the increase of large scale exploration over the next five to ten years, the area can become one of the truly large prolific petroleum areas of the western hemisphere.



MAP No. 2.

SEDIMENTARY GEOLOGICAL PROVINCES

CANADA LANDS

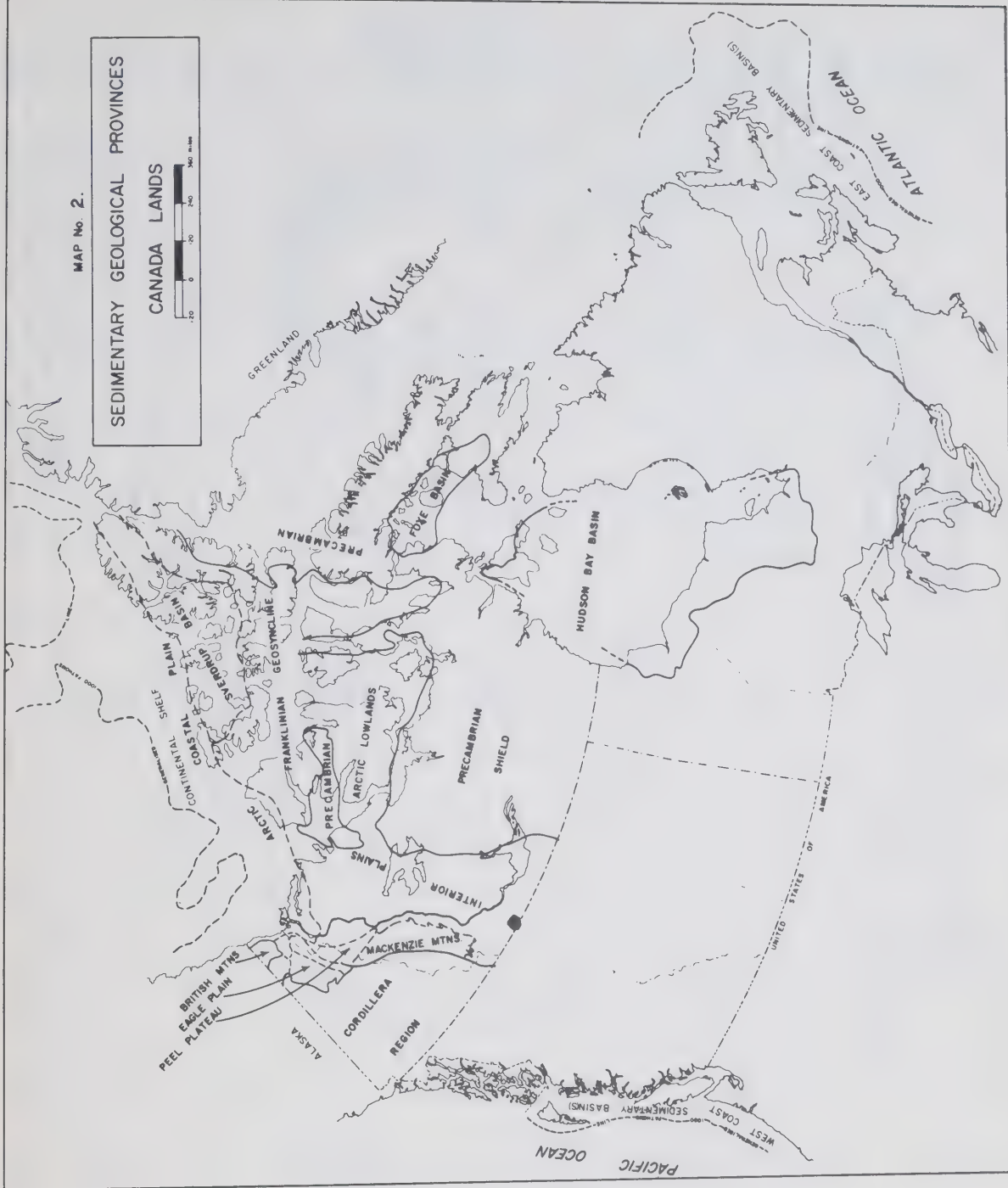


Fig. 1.

ACREAGE-HOLD UNDER OIL & GAS PERMIT YUKON TERRITORY AND NORTHWEST TERRITORIES

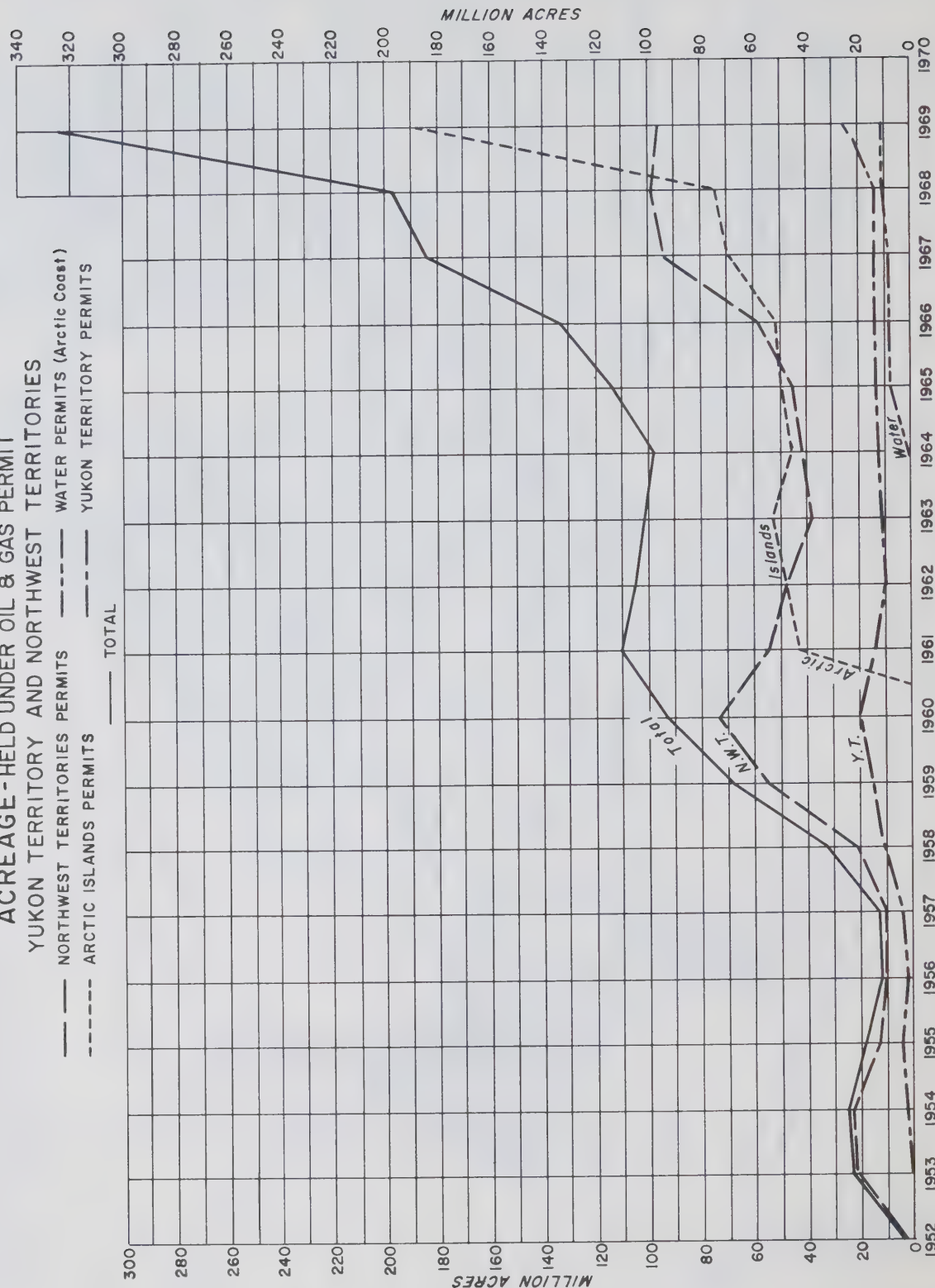


TABLE I

	Sedimentary Area (sq. miles)	Sedimentary Volume (cu. miles)	Crude Oil*		Natural Gas*	
			(thousands of barrels)	(millions of cu. feet)	(millions of cu. feet)	(millions of cu. feet)
			Produced	Remaining Proven	Produced	Remaining Proven
Manitoba and Saskatchewan	176,623	168,072	841,200	791,619	654,105	728,967
Alberta	236,893	341,715	2,456,681	7,030,049	10,544,054	36,890,431
British Columbia	50,688	115,318	86,468	294,246	1,348,231	7,752,745
Yukon	43,000	64,500	—	—	—	—
Northwest Territories (Mainland)	204,794	267,133	11,389	47,848	8,584	107,698
Arctic Islands	350,000	663,500	—	—	—	—
Total						

*Source: Canadian Petroleum Association

All aspects of oil and gas operations in the Yukon and Northwest Territories are administered by the Department of Indian Affairs and Northern Development, specifically by the Oil and Gas Section of the Oil and Mineral Division. It is the intent of the Department to provide for the orderly exploration and exploitation of oil and gas, thereby achieving benefits of a local nature to the specific areas involved and to the people of Canada in general through the attendant revenues accruing to the Crown.

The Minister and officers of the Department of Indian Affairs and Northern Development who are responsible for administering oil and gas resources in the Northwest Territories and Yukon, and northern offshore areas, are

Minister	— Hon. Jean Chrétien, P.C.
Deputy Minister	— J.A. MacDonald
Assistant Deputy Minister — Economic Development	— J.-B. Bergevin
Director — Development Branch	— A.D. Hunt
Chief, Oil and Mineral Division	— Dr. H.W. Woodward
Administrator, Oil and Gas	— Dr. H.W. Woodward
Supervisor, Geological Operations Unit	— S.A. Kanik
Supervisor, Geological Evaluation Unit	— J. Hawryszko
Supervisor, Land Unit	— P. Sullivan
Oil Conservation Engineer	— B.H.J. Thoms, Calgary, Alberta.

CURRENT LAND ACTIVITY

The Arctic Islands developed into the glamour “oil boom” of the year. The demonstrated viability of the Panarctic Oils Ltd. and encouragement from the Prudhoe Bay discoveries triggered a rush for Arctic land holdings — more than 114 million acres were acquired in 1968, more than doubling the acreage held under permit in 1967. Industry has acquired almost all of the geologically prospective areas in the Archipelago without regard to water depths or Arctic problems. With the continuing success at Prudhoe Bay, industry pushed the exploration frontier westward into the Arctic Ocean along the western shelf of the Islands. Many permit holdings are located in marine tracts beyond the 500 meter depth contour.

While the mid-1968 discoveries of apparently vast oil accumulations at Prudhoe Bay on the Alaska North Slope dramatically pointed up the potential of Canada’s North, much of the activity on the mainland was based on new exploration plays.

The sedimentary area of the Northwest Territories mainland remains essentially unchanged as to the total area under permit and lease. Important new activity has developed on the mainland primarily in a belt along the eastern limit of sediments from Great Slave Lake to the Arctic Ocean. Several large blocks of permits have been granted along this belt. Permits were also issued for tracts along the eastern flank of the Mackenzie Mountains. The decline in permit holdings on the mainland Northwest Territories has been largely due to the conversion to leases and to the retention of much of the surrendered permits in Crown Reserve.

Acquisitions of oil and gas lands in the Yukon Territory approximately doubled during 1968, with a net increase in permit holdings of just over 12 million acre. Much of the new acquisitions were located in the Old Crow area of the northern Yukon and on the Peel River area of northeastern Yukon.

Table No. 2 summarizes the number of permits and leases and relevant acreage held on December 31, 1968.

TABLE NO. 2

**No. of Permit and Leases and Relevant
Acreage — 31 December 1968**

<u>Permit</u>	<u>No. of Tracts</u>	<u>Acreage</u>
N.W.T. Mainland	2,063	96,707,141
Y.T. Mainland	619	26,376,093
Arctic Islands	3,892	188,358,592
Arctic Coast Marine	230	10,572,052
TOTAL PERMITS	6,804	322,014,052
 <u>Lease</u>		
N.W.T. Mainland	299	1,999,901
Y.T. Mainland	55	186,092
Arctic Islands	—	—
Arctic Coast Marine	—	—
TOTAL LEASES	354	2,185,993

The Department's call for tenders on October 31, 1968, illustrated industry's continuing willingness to actively explore for oil and gas north of 60. Successful tenders totalling 2.8 million dollars in cash bonuses, and 10.9 million dollars in exploratory expenditure commitments were accepted, marking the "sale" as one of the most significant in the history of the Department.

The overall industry holdings north of 60 increased by 126.2 million acres (64%) to 324.2 million acres (see Figure No. 1). Of this total approximately 125 million acres were acquired as permits and 1.2 million, as leases.

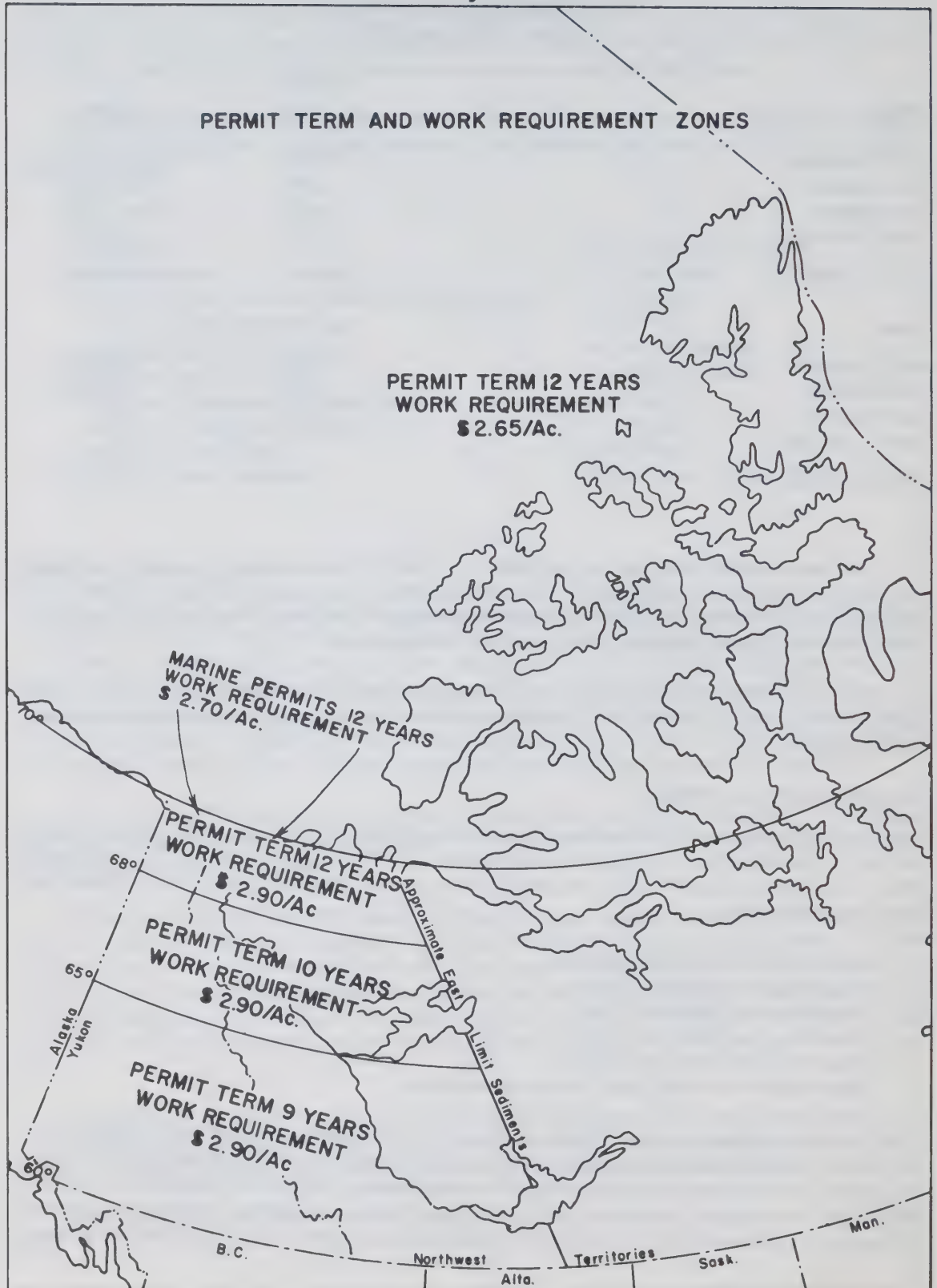
OIL AND GAS REGULATIONS

It is the intention of the Department to provide a regulatory climate that will best encourage and provide for active exploration and orderly exploitation of the oil and gas north of 60. The Regulations in effect for oil and gas administration are made pursuant to the Territorial Lands Act, and Public Lands Grants Act, and include:

- Canada Oil and Gas Lands Regulations
- Oil and Gas Land Order No. 1-1961
- Oil and Gas Land Order No. 2-1961
- Oil and Gas Land Order No. 1-1962
- Oil and Gas Land Order No. 2-1962
- Canada Oil and Gas Drilling and Production Regulations

The *Canada Oil and Gas Land Regulations* came into effect June 6, 1961, and have provided the basic structure for the disposal and management of the Canada Oil and Gas Lands. Exploratory rights to available grid areas or half grid areas are granted as permits upon application. The cost of this grant is a permit fee of \$250.00 and a deposit of money, bonds, or promissory notes is required as guarantee that minimum exploratory expenditures will be made. The required deposits in respect to work guarantees commence at

Fig. 2



5¢ per acre and escalate to 50¢ per acre in specific steps during the life of the permit. The total minimum expenditures on exploratory work amount to \$2.65 per acre in the Arctic Islands, \$2.70 per acre in the Marine areas, and \$2.90 per acre in the mainland south of latitude 70°. The permittee upon satisfactory performance of exploration work can credit expenditures for the return of the basic deposit. Unallocated expenditures may be carried forward to satisfy up to one-half of lease rentals, Figure No. 2 illustrates graphically the minimum expenditures.

The work requirements are modified and eased by provisions in the regulations granting grouping and off-permit work privileges. These provisions provide much flexibility for the conception and performance of significant work programs.

The terms of permits vary depending upon the location (and consequent general difficulty of mounting significant exploration efforts) from 3 years in the southern land areas to six years in the Arctic. All permittees are entitled to six one year renewals, allowing for a total permit life of 9 to 12 years. A number of permits in the Arctic Islands issued prior to 1968 carrying an original term of 8 years and may be extended by renewal for a total life of 14 years. Figure No. 3 illustrates permit term and deposit requirements per acre for Canada oil and gas lands.

The holder of an Exploratory Permit has an exclusive option to acquire leases with a 21 years original term on up to 50% of the permit area. The leases may be no smaller than one section or larger than 6 sections by 3 sections. The lease rentals, 50¢ per acre in the first year, and \$1.00 per acre for the second and subsequent years, are reducible by one half through the application of new expenditures or unallocated prior work expenditures throughout the life of the lease or until the commencement of production.

With the passage of Oil and Gas Land Order No. 1-1961, permittees were granted an exclusive 60 day option to acquire leases on the permit area surrendered to the Crown following the initial lease selection. The leases selected under this option carry additional royalties which vary with both location and rate of production. Figure No. 4 is a map showing the additional royalty rates by areas. Further details are outlined in the Schedules contained in the Canada Oil and Gas Land Regulations.

All oil and gas rights which are terminated become a part of the Crown Reserve. Three Oil and Gas Land Orders (nos. 1-1961, 1-1962, and 2-1962) have been issued to provide the basic means of returning the Crown Reserves to active exploration. Disposal of Crown Reserve land can be made only at public sale through a call for tenders. The three basic forms of tender are: cash bonus, work bonus, and drilling commitments, and the rights offered may be individual leases, permits, or blocks of leases or permits. The Land Orders and portion of Regulations which refer to the disposal of acreage are illustrated graphically in Figure No. 5. Individual leases and permits are offered for cash bonus; blocks of leases, for cash bonus and an undertaking to drill to a specified depth; and blocks of permits for work bonus. The offering of blocks of permits for work bonus has been very favourably received by Industry and since the original offering in 1962 has provided exploration expenditure commitments totalling approximately 35 million dollars.

Several amendments to the Regulations were passed during 1968, most of the amendments were designed to clarify and define elements of oil and gas land administration.

EXPLORATION ACTIVITIES — 1968

Oil and gas expenditures in the Yukon and Northwest Territories have exceeded 30 million dollars in 1968, this is an increase of about two million dollars over the previous year. Figure 6 illustrates the total expenditures recorded by the oil industry north of 60. Most of the exploration was carried out in the southern portion of the Territories and on the Eagle Plain in the Yukon Territory.

Fig. 3
ILLUSTRATING
PERMIT TERMS AND DEPOSIT
REQUIREMENTS PER ACRE

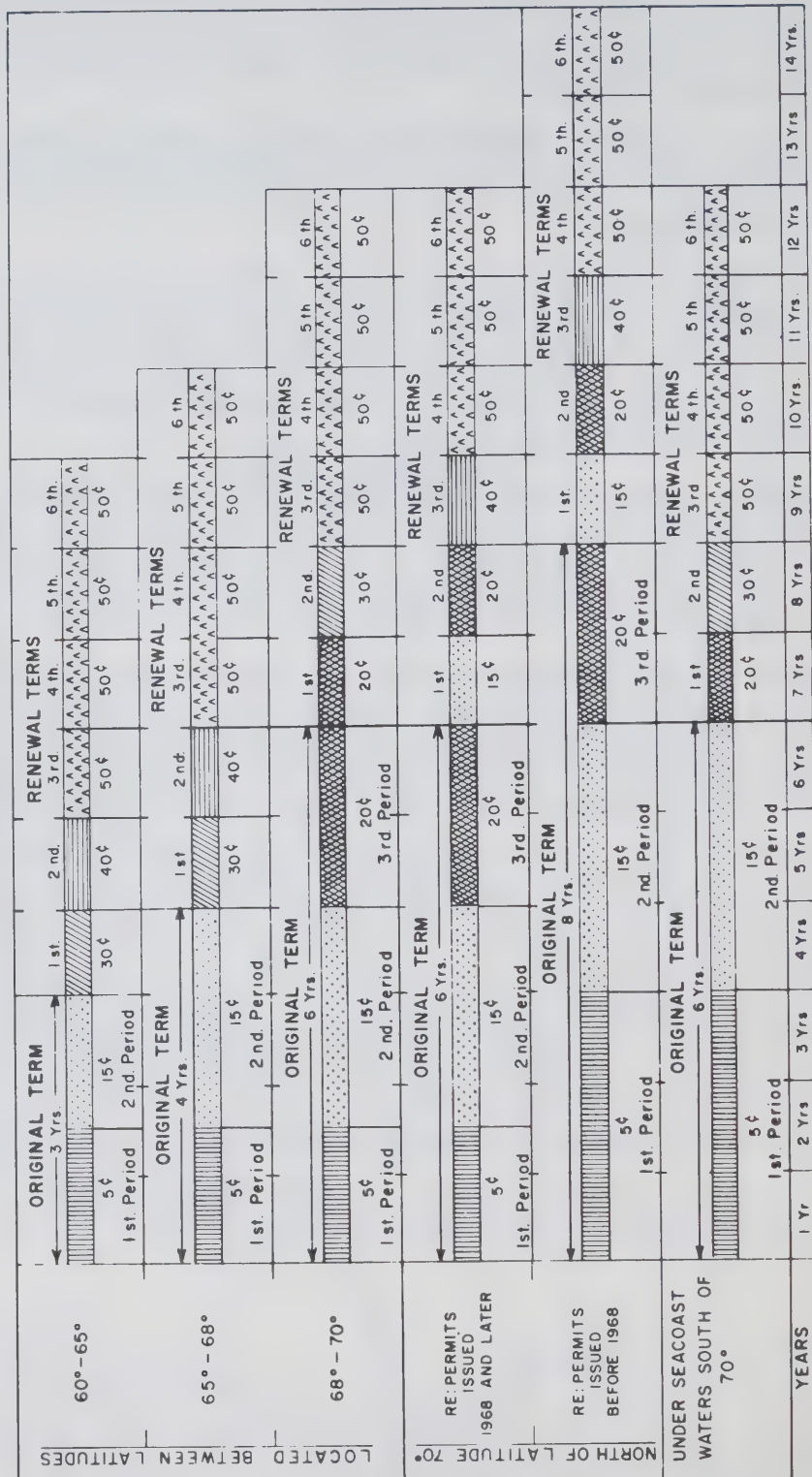


Fig 4.

MAP SHOWING ADDITIONAL ROYALTY RATES
BY AREAS

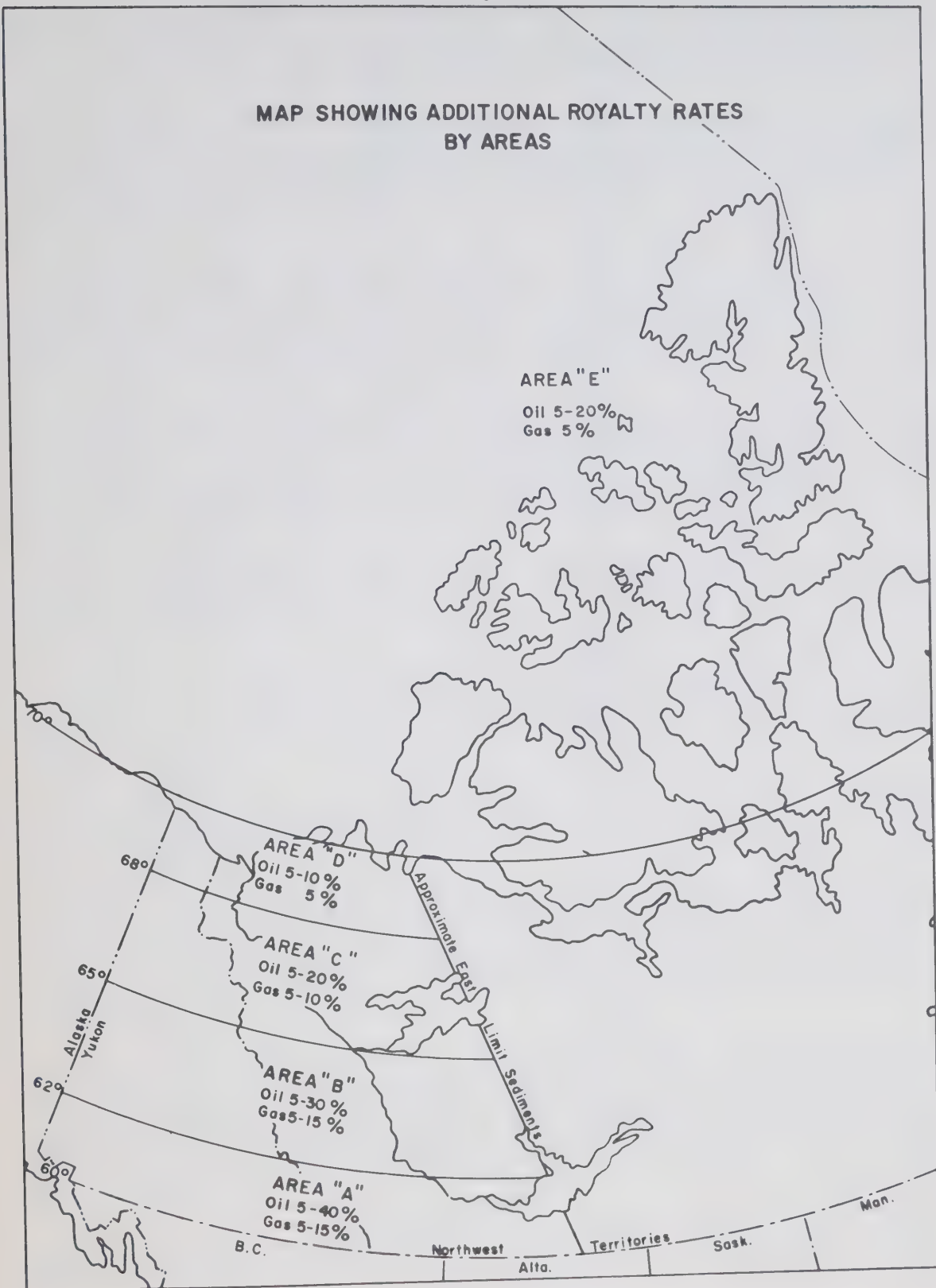
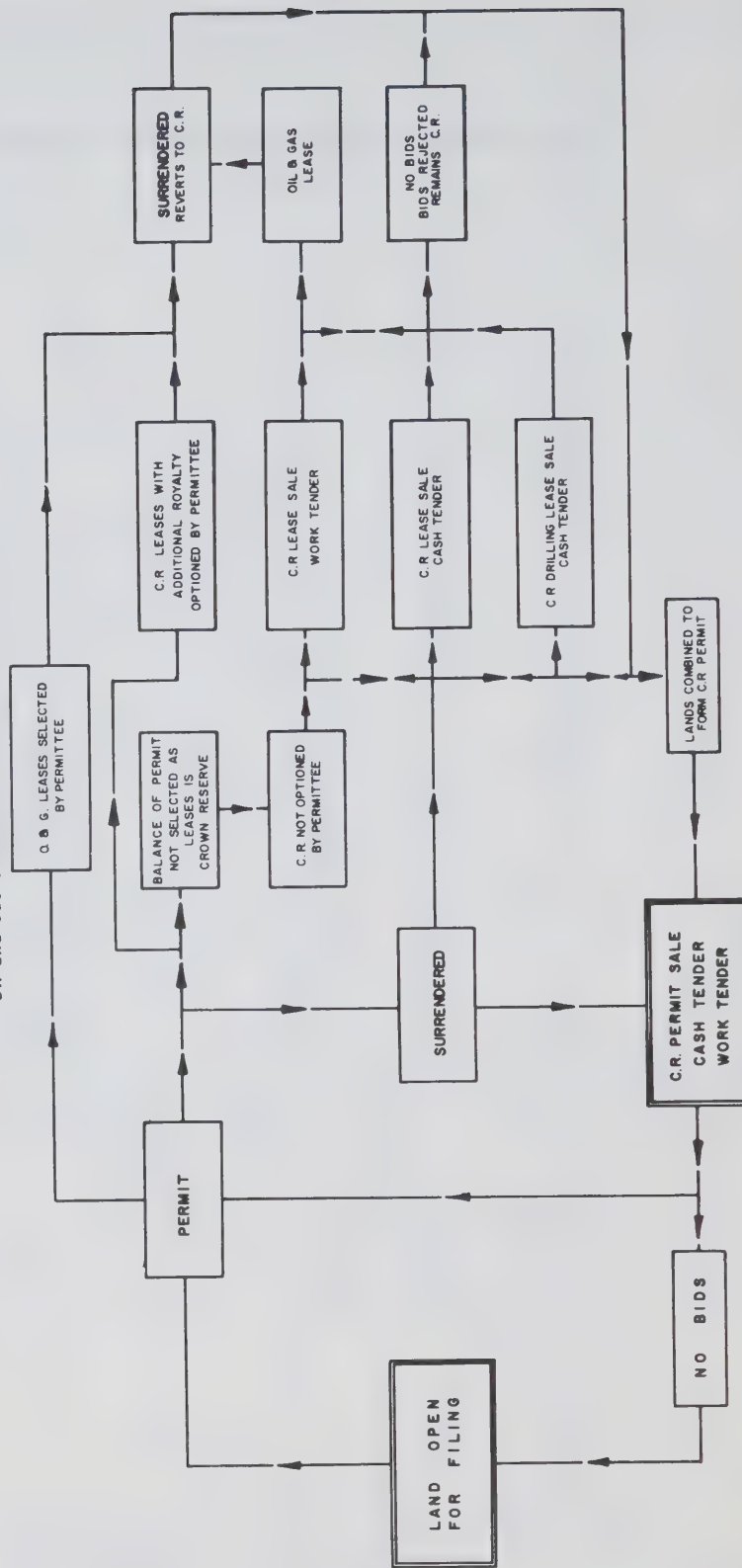


Fig. 5.
 FLOW CHART SHOWING METHODS OF OIL & GAS LANDS DISPOSAL
 YUKON TERRITORY AND NORTHWEST TERRITORIES
 Oil and Gas Section - Oil and Mineral Division



Note: "C.R." means Crown Reserve, a term applied to Oil and Gas Lands available for acquisition by tender only.

Surface geological and photogeological surveys by the oil industry decreased over the previous year, since most of the sedimentary areas have already been mapped by the major land holders. Much of the current work that is being conducted is by consultants for clients holding small acreage blocks, or for non-exclusive type of reports which are sold to several oil operators holding permits in the Territories.

A conglomerate of consulting firms in Calgary organized "Operation Geoquest" in 1968. The project involved assorted mapping programs in the Northwest Territories south of latitude 65°. Basic information was collected by surface geologic surveys, gravity and magnetometer surveys and structure test drilling. Land holders participating in this project could allocate expenditures to permits in the Northwest Territories and Yukon Territory.

A second and more extensive project "Operation Arcticquest" was organized by the same conglomerate of consultants. The geophysical programs will be carried out along the Arctic Coastal Plain and in the offshore to about the 200 meter depth contour. Surface geologic work will be concentrated in Northern Yukon. Participants in "Operation Arcticquest" can allocate expenditures to permits approximately one hundred miles on either side of the coastline.

Seismic activity in 1968 increased by over 50% over the previous year. The magnitude of activity in this phase of exploration forecasts drilling in the future since it normally takes one to two seasons of seismic exploration to locate suitable drilling sites. Exploration activity is graphed in Figure 7. It indicates a general decrease in surface exploration over the past five years with a consequent increase in seismic activity.

Oil companies concentrated their seismic activity in the southern portion of both territories and along the Mackenzie Valley to Norman Wells. Three large scale marine seismic programs were carried out in the Beaufort Sea during the fall of 1968.

Imperial Oil Enterprises continued to carry out large reflection seismic programs in the Delta and Tuktoyaktuk areas to locate sites for their current drillers. To the east, on the mainland, Elf Exploration and Production Canada Limited continued a large geophysical program in the Anderson River-Liverpool Bay area.

Drilling activity is illustrated in "Wells Completed or Abandoned in 1968", Map No. 3, "Wells Drilled", Figure No. 8: and "Footage Drilled", Figure No. 9.

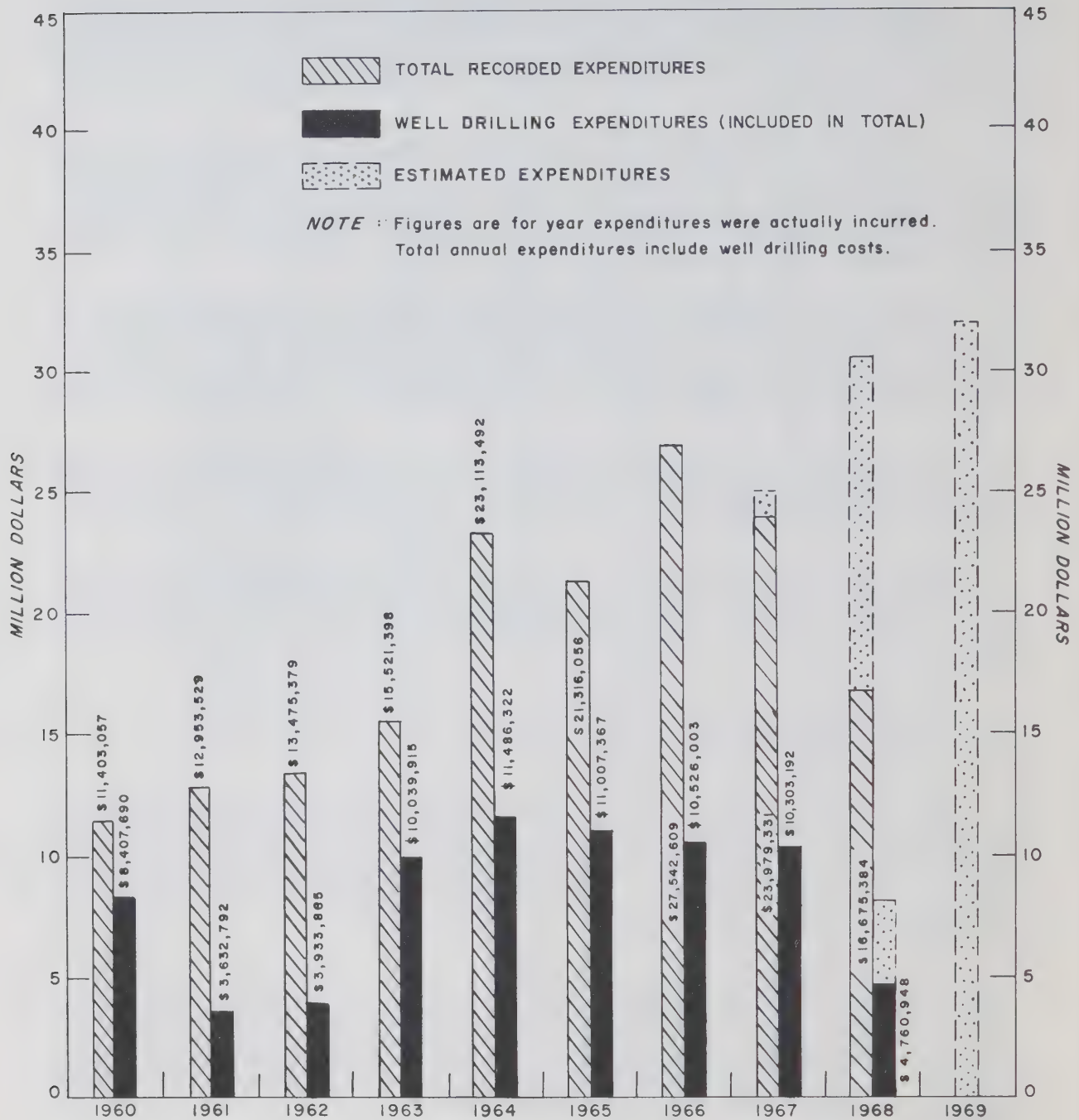
Most wells were drilled in the southern Northwest Territories. The concentration of wells drilled in the southern Territories can be attributed in part to the discovery of prolific oil and gas fields in the Middle Devonian sedimentary sequence of the adjoining sector of Alberta, to the reduction of relatively untested prospective areas in the provinces, and to the start of construction of a year round road in the southern most Territories. The road will serve to reduce the cost of exploration when equipment and supplies can be moved overland during 12 months of the year.

Though the "Number of Wells Drilled in 1968" and "Footage Drilled" exceeded that in 1967, drilling expenditures for the year were approximately two million dollars lower than in the previous year. The decrease in expenditures can be attributed to the areal distribution of the wells in that about thirty wells were drilled in the Great Slave Lake area where the sediments are thin, wells average out to about 3,000 feet, the well sites were accessible to existing roads, thus the average cost of wells decreased significantly over 1967.

Drilling in the Yukon was reactivated by Canoe River Exploration Limited in the Eagle Plain area. The Company carried out a two well program, one well was completed as a suspended gas well, the other

Fig. 6.

OIL & GAS EXPLORATORY EXPENDITURES





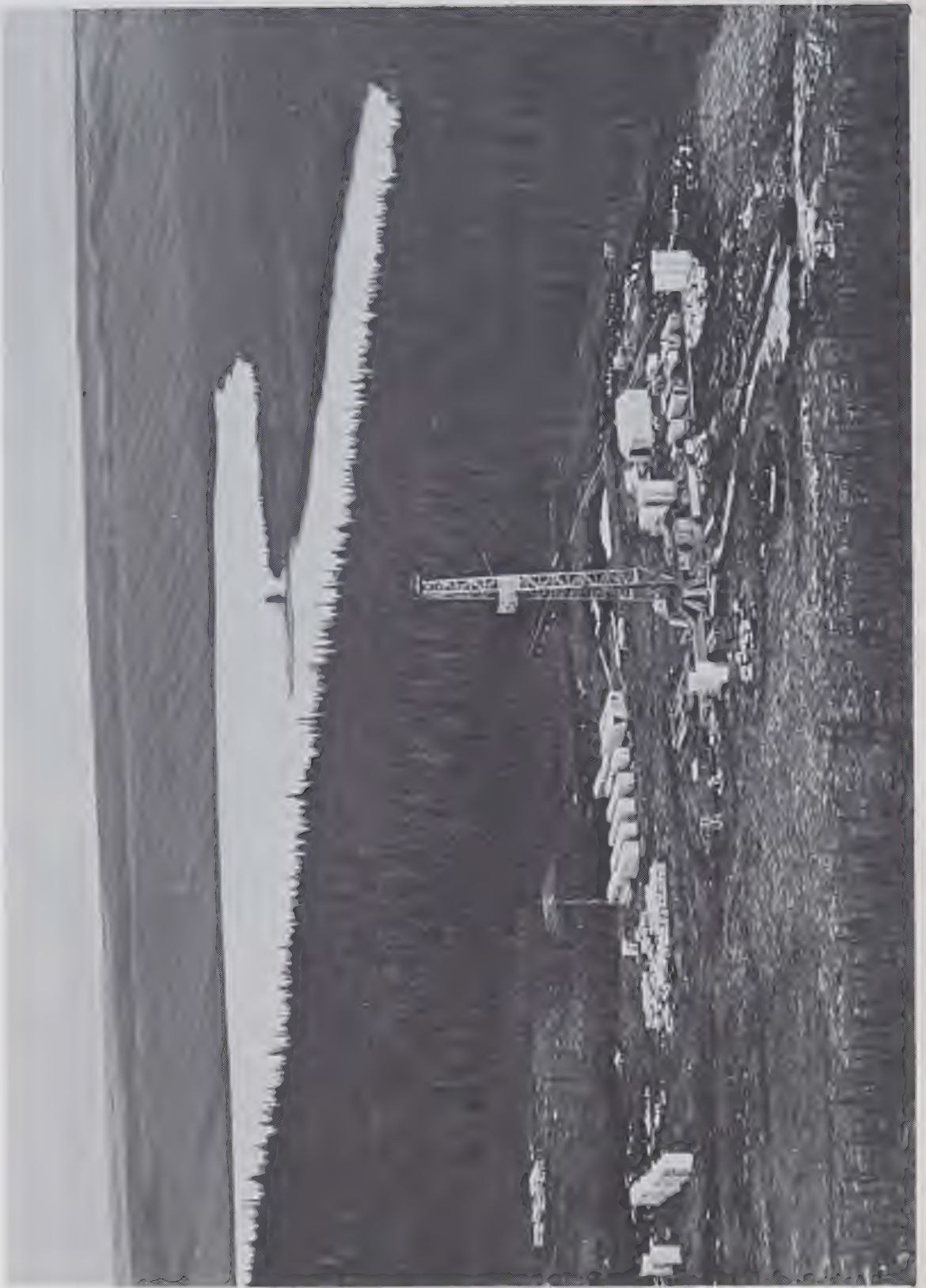


Fig. 7.
EXPLORATION ACTIVITY
YUKON TERRITORY AND NORTHWEST TERRITORIES

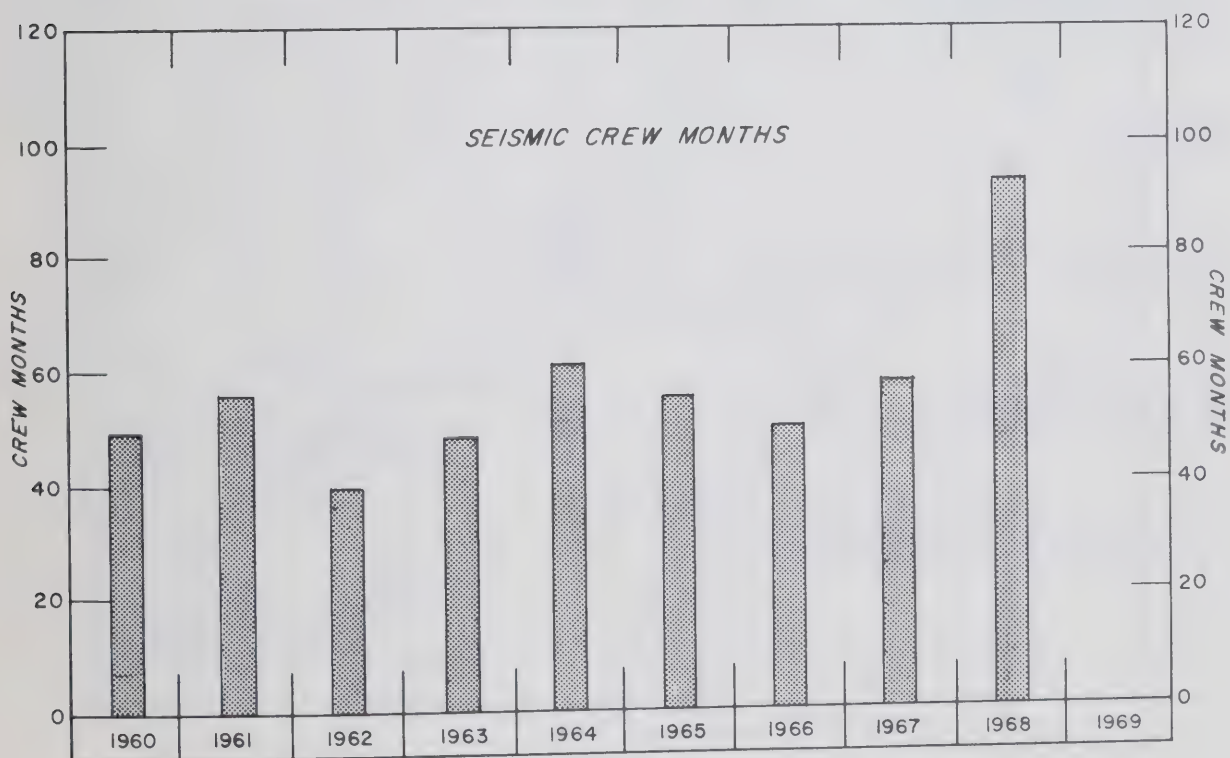
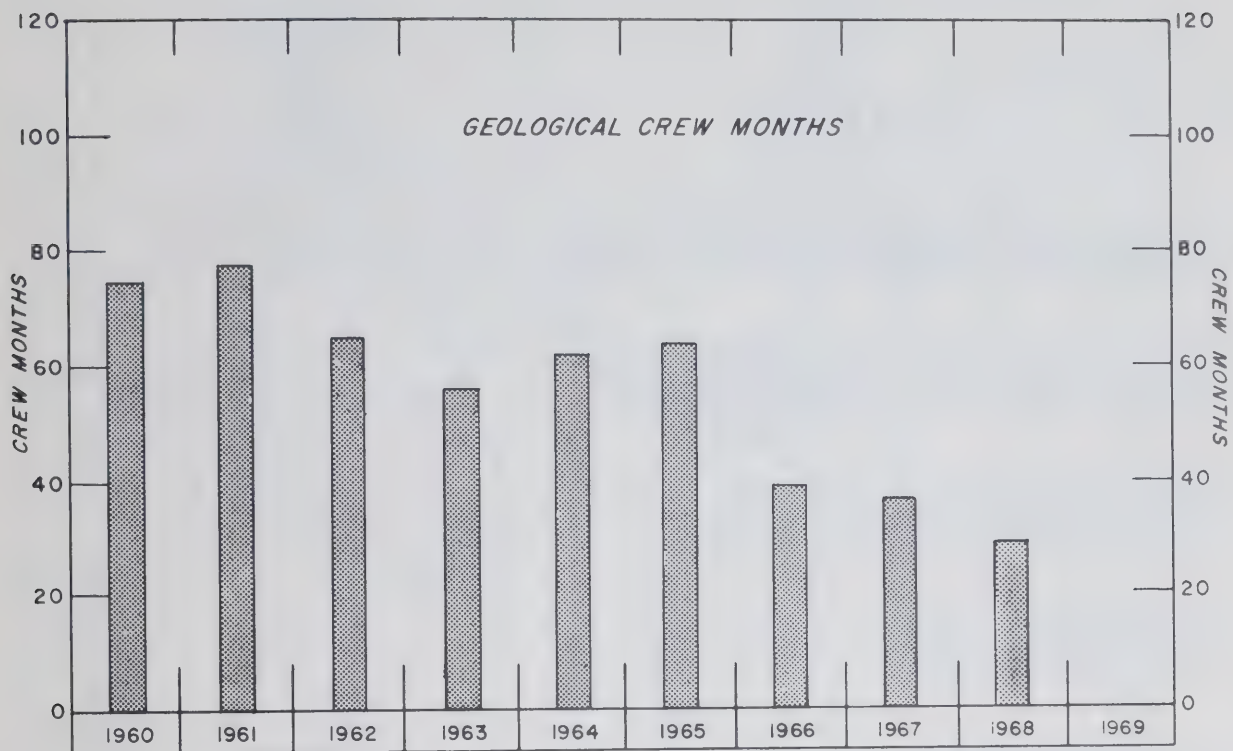


Fig. 8.

WELLS - DRILLED
YUKON TERRITORY - NORTHWEST TERRITORIES
NUMBER OF WELLS DRILLED TO END 1968, 375.

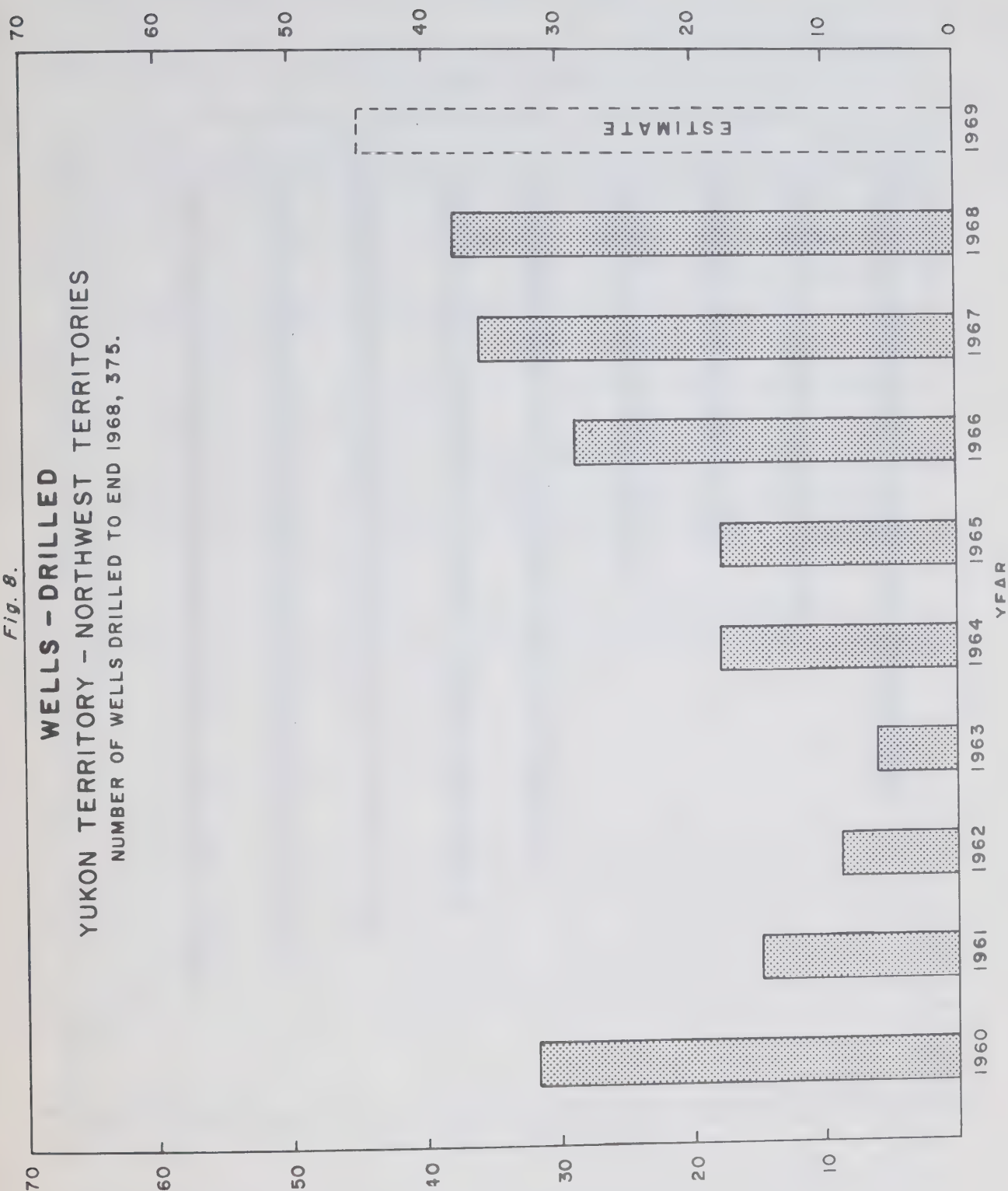
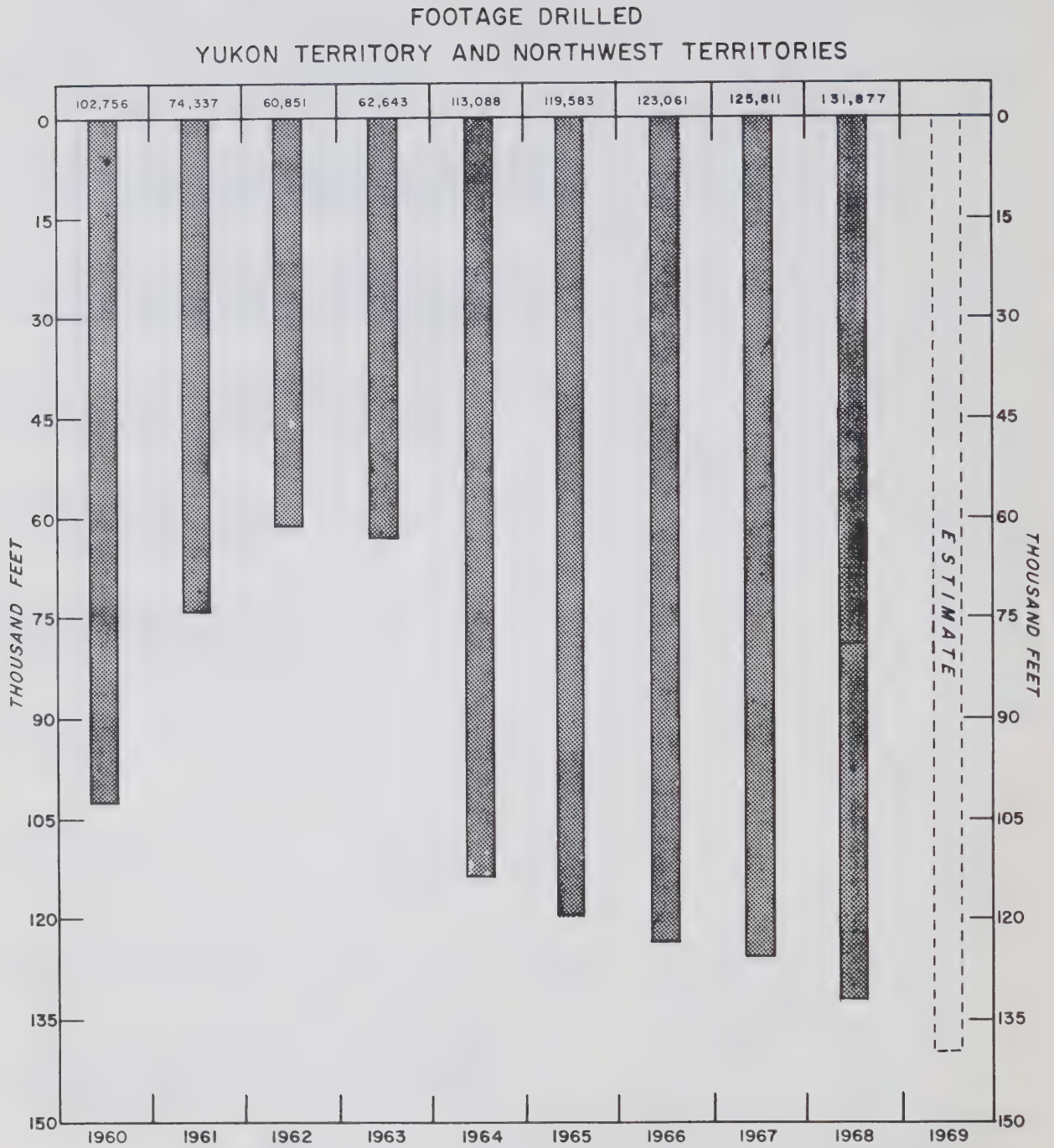


Fig. 9.



well was dry and abandoned. In this program, the Company was assisted by a Northern Mineral Exploration Grant, equivalent to 40 per cent of the cost of this exploratory venture.

In the Watson Lake area, a stratigraphic well was drilled to 3,750 feet. No evidence of oil or gas were encountered and the well was abandoned.

In the Liard area, a well, Pan Am Beaver Y.T. G-01, is being drilled in the Yukon Territory, immediately north of the Yukon-British Columbia border, and on the same structure as the completed Beaver River gas wells in British Columbia. Since it is only a mile and a half step-out from the gas wells in British Columbia, the chances of this well encountering the gas reservoir are excellent. A second well, Pan Am-Shell Merrill J-76, 18 miles north of British Columbia border is currently drilling at about 5,000 feet. It appears to be located on the north end of the complex structure which contains the Beaver River pool.

Two wells were commenced in the area of the Mackenzie Delta by Impeperial Oil, one of which is in partnership with Shell Oil Canada and British American Oil Co. (now Gulf Canada Ltd.). Both will be completed in the spring of 1969.

For a general review of Panarctic's operations in 1968 and proposed plans for 1969, please refer to the following "Exploration Highlights" section.

Development drilling was activated in the Norman Wells field. Two oil wells were completed on Goose Island. After stimulation, each well is now capable of producing up to 350 barrels of oil per day. A third well was drilled on the down-dip edge of the field to initiate a secondary recovery program. Up to 15,000 barrels of water are being injected daily to maintain reservoir pressure and to increase production efficiency.

Exploration activities for 1969 will increase substantially over 1968. With indications of large marine seismic programs planned for the offshore areas, seismic "crew months" should increase by 40-50 . The commencement of Panarctic's drilling program and proposed wildcat wells in the Delta area, should increase the number of "Wells Drilled" to at least 45 in 1969.

EXPLORATION HIGHLIGHTS

Panarctic Oils Ltd.

Panarctic Oils Ltd. is now in its second year of operations. During the past two years it has acquired 45,229,665 acres of oil and gas permits in the Arctic Islands from over 75 companies and individuals. The company has assumed all the work obligations and is beginning to carry out a systematic program of exploration over the four years to June, 1971. The initial field exploration commenced in March 1968 when a seismograph and a gravity meter survey party were flown to Melville Island. The six month geophysical program was completed successfully with track vehicles assisted by helicopters. Base camps with airstrips were set up at Winter Harbour, Marie Bay, Sherard Bay, and at Rea Point, all on Melville Island. Stock piling of fuel and drilling supplies were established at Resolute Bay, Sherard Bay and Rea Point.

The drilling phase of the program will commence in February of 1969 when two drilling rigs will be flown to Melville Island by a Hercules aircraft. The Arctic Islands drilling program involves the drilling of 17 wells which includes nine deep tests, six medium tests, and two shallow tests.

Other proposed operations for 1969 are geological field surveys and gravity meter surveys in the central Arctic Islands, and seismic programs on Ellef and Amund Ringnes Islands and Ellesmere Island,



To the end of January, 1969 Panarctic Oils has received a total of \$5,012,500 of the \$9,022,500 government grant.

Oil and Gas Production and Conservation Act

The need for an Oil and Gas Act to provide statutory authority for control of oil and gas production, the prevention of waste, and safety of operations in the north was first recognized by the Department early in 1960. Over the last seven years work on the proposed Act has continued. This has included research into the nature of the matter to be included, obtaining approval of the basic policies to be expressed in the Act, and the holding of relevant discussions with the Canadian Petroleum Association, the Chairman of the National Energy Board and his senior staff, and the Deputy Minister of the then Department of Mines and Technical Surveys and his senior staff. Bill S-29 "An Act respecting the production and conservation of oil and gas in the Yukon Territory and Northwest Territories" received first reading in the Senate on February 4, 1969.

Norman Wells Agreement

The Canadian Government entered into an agreement with Imperial Oil Ltd. on July 21, 1944. The agreement called for Imperial Oil Ltd. to develop the oil field at Norman Wells and to sell the oil products produced. The Government receives five per cent royalty on 2/3 of oil and gas production, which is Imperial's unit interest and all revenues from the sale of oil products on the remaining 1/3 of the field, less costs of production, refining, marketing and management fee. The initial term of 21 years of the original agreement ended on May 2, 1966. The agreement has been renewed for a further 21 years.

Gas Purchase Agreement

Westcoast Transmission Company and Pan American Petroleum Corporation have signed a contract for dedication of Pan American's partially developed gas reserves at Beaver River, three miles south of the Yukon Territory, and at Pointed Mountain in the southwest sector of the Northwest Territories, twenty miles north of the British Columbia Border. The reserves proven and those developed in the Beaver River – Pointed Mountain area are needed by Westcoast Transmission to complement reserves required to guarantee a 25 year life for daily gas delivery commitments.

The Beaver River gas pool in northeast British Columbia was discovered in 1958, and the Pointed Mountain gas pool in the southwest sector of the Northwest Territories in 1966. The Gas Purchase Agreement covers a purchase of natural gas at maximum daily delivery rates of over 200 million cu. ft. on November 1, 1970. The contract covers also the construction of a 20 inch gas pipeline to extend north for 110 miles from the present terminus of the Westcoast Transmission Pipeline Company at Fort Nelson to the Beaver River gas pool.

Two gas wells have been completed in the Pointed Mountain gas pool and a third one is currently near completion in the south sector. A fourth well in the north sector of the pool will commence drilling in the spring of 1969. It is expected that the gas reserves which may be proven at Pointed Mountain will warrant application for export-import licences for an addition of 100 million to 200 million cu. ft. of gas in late 1969 and early 1970. Gas production is expected to commence early in the 1970's.

RESERVES

A. Crude Oil Reserves

Norman Wells Field

The crude oil reserves are calculated volumetrically at 419,000,000 barrels of stock tank oil in place. Since no recovery factor can be substantiated at the present time, recoverable reserves for this field are not estimated. To date, a total of 11,389,000 barrels of crude oil have been produced from the field.

B. Natural Gas Reserves

Gas reserves are not published since most of the gas discoveries are still in the one well field stage, or in the case of Pointed Mountain only two wells have been completed to date, as gas wells.

REFINING OPERATIONS

A. Refinery Capacity

The only operating refinery located north of 60 is at Norman Wells operated by Imperial Oil Ltd. The refinery has a daily capacity of 1500 barrels and a stream day capacity of 1600 barrels. An extensive modernization program to increase capacity to over 2000 barrels will commence in 1969.

REVENUES

Sales of oil and gas permit and lease areas are generally held three times a year. The sales take place in the months of January, April and October so that the successful tenders can take advantage of the current season to commence exploratory work.

Two oil and gas permit and work bonus block sales were held in 1968. Individual grid areas were offered for cash bonus, and blocks of permits, some of which consisted of up to 9 grid areas including over 400,000 acres were offered for "work bonuses". Bonus deposits received for the blocks are returned on completion of satisfactory work performance. Table No. 3 summarizes the results of two sales held in 1968 — the normal April sale was not scheduled.

Revenues from these sales, lease and permit fees, royalties, rentals, etc. received in the fiscal year are shown in Figure No. 10 and Table No. 4. Though "work bonus" tenders are not construed as revenue to the Government, they are illustrated in Figure No. 11 for reference purposes.

For the benefit of Industry and the Cominon Bureau of Statistics which utilize the calendar year as the time unit, Table No. 5 was compiled to illustrate the relations between activities, revenues and expenditures.

Estimates for the 1968 royalty and revenues are in the order of \$50,000 but this data has not been included for the year 1968. Therefore a small adjustment will be made in the figures for next year's edition. Due to the drilling of three wells and the installation of a secondary recovery project on Goose Island the Government's share of revenues will be considerably reduced from previous years.

PUBLICATIONS

A. Maps

Many maps dealing with the northern resource activities are published by the Division and are available from the Oil Conservation Engineer, Calgary, Alberta, or from the Chief, Oil and Mineral Division, Ottawa. See the Oil and Mineral Division's list of "available maps".

B. Reports Available from the Queen's Printer and the Oil Conservation Engineer Calgary, pre-payment is required.

Schedule of Wells 1920 — 1960	— \$3.00
Schedule of Wells 1920 — 1961	— 4.00
Schedule of Wells 1920 — 1963	— 4.00
Schedule of Wells 1962 — 1964	— 2.00
Schedule of Wells 1965	— 3.00
Schedule of Wells 1966	— 3.00

Fig. 10.

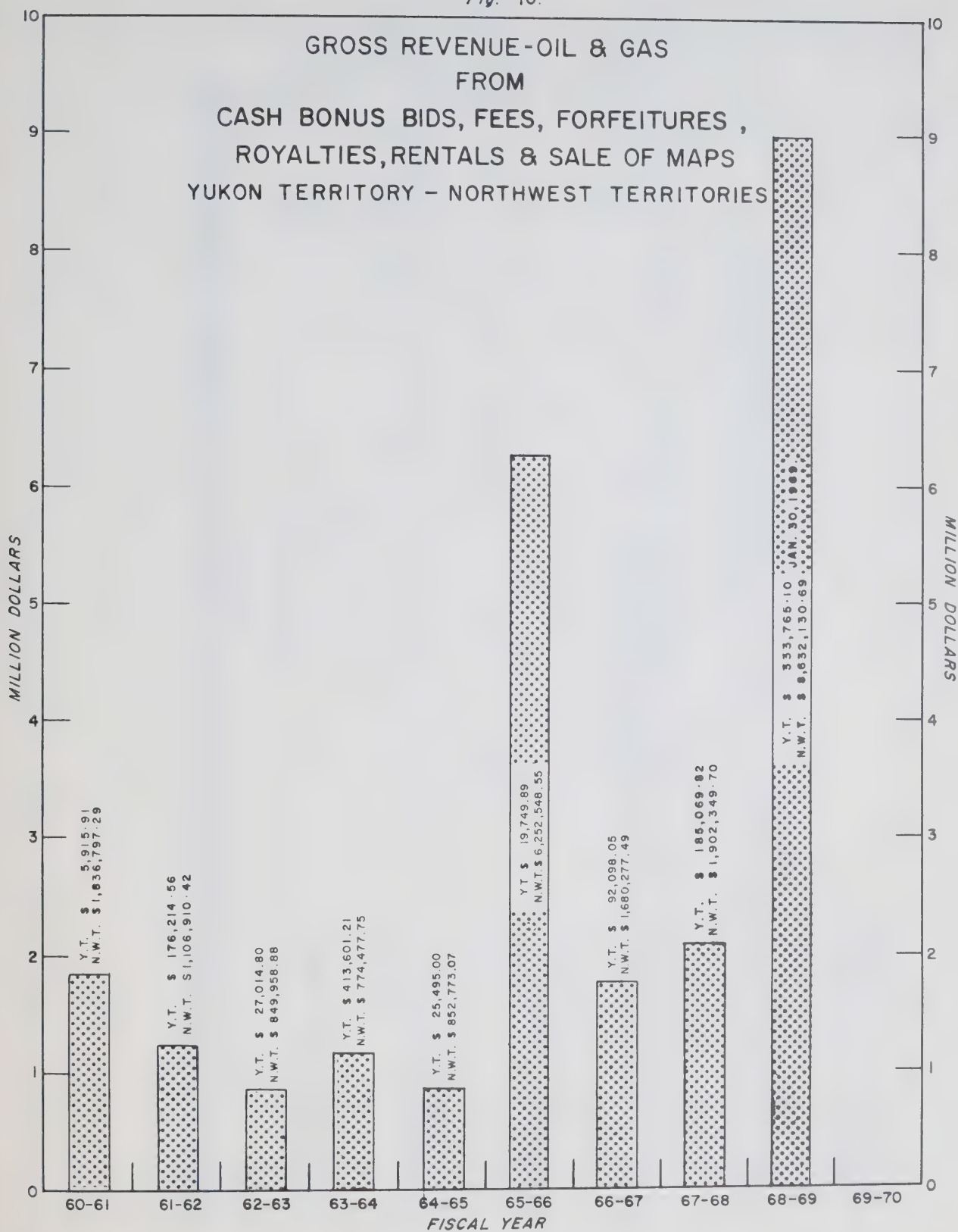


Fig. II.

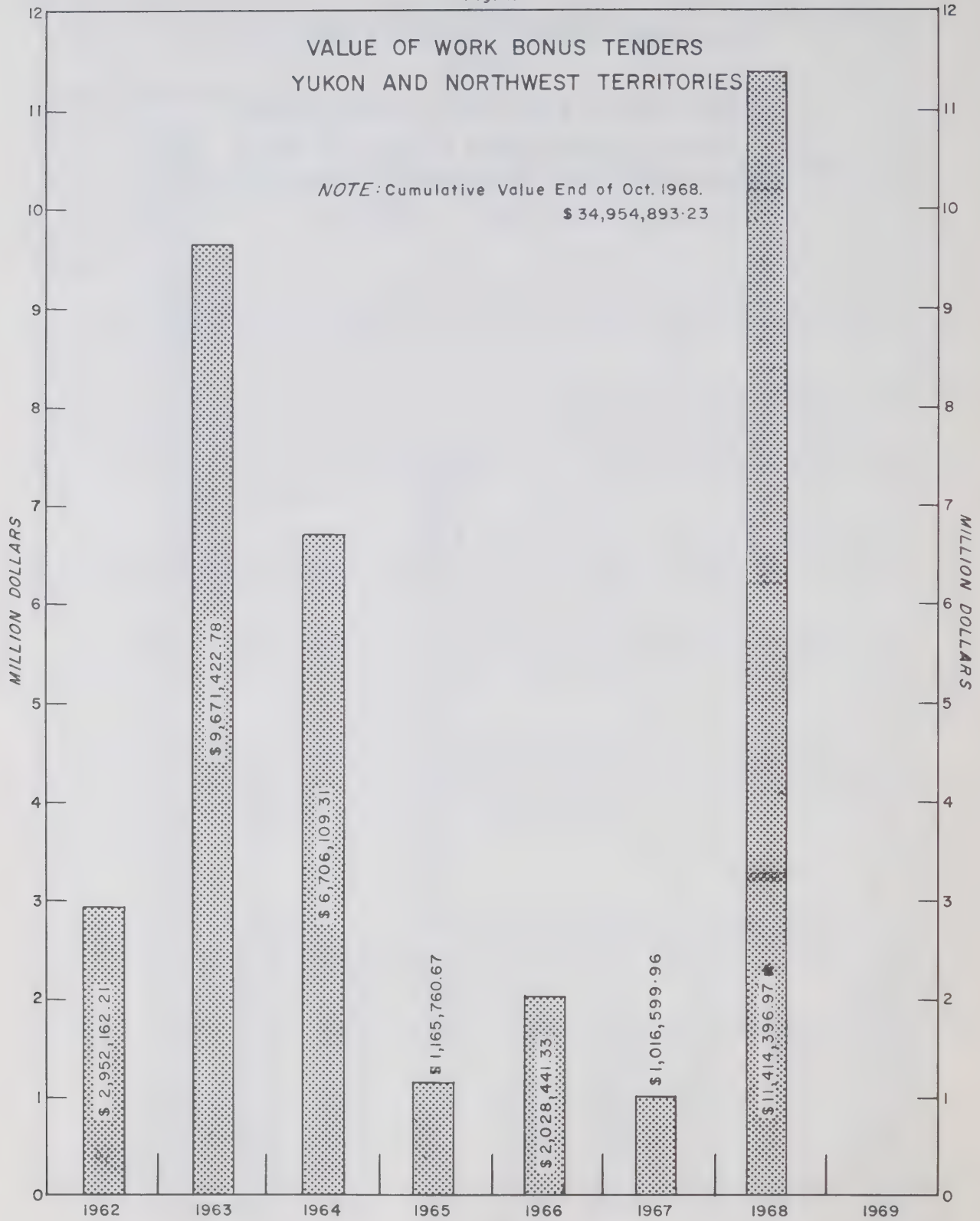


TABLE NO. 3

SUMMARY OF 1968

OIL AND GAS SALES

CASH BONUS PRACELS

Date	Acreage Offered at Sale	Acreage Sold	Percentage of Acreage Sold	Total Bids Received	Max. Bid per acre	Min. Bid per acre	Average Bid Per Acre
1968							
Feb. 1, 1968	1,755,419	1,504,384	86%	\$ 347,333.04	\$ 1.95	\$0.01	\$0.23
Oct. 31, 1968	2,069,168	1,682,404	81%	2,795,877.95	15.45	0.05	1.66
WORK BONUS BLOCKS							
1968							
Feb. 1, 1968	1,972,104	970,934	49%	505,002.46	1.02	0.19	0.52
Oct. 31, 1968	5,331,217	4,170,124	78%	10,909,394.51	8.07	0.11	2.61

Revenue Oil and Gas-Northwest Territories
(By Calendar Year)

Year	Transfers				Lease Fees	Rentals	Royalties	Forfeiture	Bonus	Misc.	Total
	License Fees	Permit Fees	Fees								
1963	\$1,500.00	\$ 19,550.00	\$ 8,200		\$ 140.00	\$ 157,396.56	\$ 69,882.00	\$ 39,343.25	\$ 668,660.05	\$ 633.33	\$ 766,590.47
1964	1,250.00	45,850.00	5,750		—	83,603.58	51,258.00	1,944.05	95,306.73	398.75	699,036.11
1965	1,425.00	707,750.00	8,275		890.00	280,449.08	178,878.00	78,826.31	908,493.19	995.00	1,781,091.62
1966	1,425.00	300,463.15	13,150		420.00	475,513.08	213,571.00	90,410.40	5,079,885.17	878.80	6,185,736.60
1967	2,175.05	96,250.00	10,475		760.00	682,500.74	106,229.00	36,106.20	484,623.02	929.72	1,409,048.73
1968	3,198.18	631,550.00	32,930		2,910.00	1,431,066.77	—	394,254.08	2,871,080.65	1,398.27	5,397,791.75
1968 ¹							50,000.00				5,447,791.75

Revenue Oil and Gas-Yukon Territory
(By Calendar Year)

1963	—	13,500.00	—		30.00	66,100.00	—	—	383,461.21	—	403,601.21
1964	—	16,750.00	—		—	13,220.00	—	—	—	—	29,970.00
1965	25.00	5,500.00	—		—	13,220.00	—	6,529.89	—	—	25,274.89
1966	—	13,000.00	225		—	25,865.00	—	41,156.00	—	—	80,246.00
1967	—	9,750.00	—		70.00	11,888.25	—	5,602.05	16,616.00	—	43,926.30
1968	—	86,750.00	875		330.00	2,809.25	—	147,680.76	248,615.66	—	487,060.67

Grand Total Revenues-Oil and Gas
Northwest Territories and Yukon Territory
(By Calendar Year)

1963	\$1,170,191.68	1965	\$1,806,366.51	1967	\$1,452,975.03
1964	729,006.11	1966	6,625,982.60	1968 ¹	5,884,852.42

¹Includes estimated 1968 royalty and crown production revenues from Norman Wells Oil Field

Revenues Oil and Gas-Northwest Territories
(By Fiscal Year)

Year	Transfer		Lease Fees	Rentals	Royalties	Forfeitures	Cash Bonus	Misc.	Total
	License Fees	Permit Fees							
1963-64	\$1,950.00	\$183,250.00	\$ 7,550.00	\$ 40.00	\$ 157,519.99	\$ 69,882.00	\$ 18,288.12	\$ 579.58	\$ 774,477.75
1964-65	7,275.00	551,500.00	7,125.00	30.00	99,977.08	51,528.00	42,822.74	874.00	852,773.07
1965-66	1,425.00	344,000.00	7,850.00	1,050.00	350,130.05	178,878.00	69,952.16	674.30	6,252,548.55
1966-67	1,525.00	167,403.15	14,425.00	250.00	500,861.08	213,571.00	94,234.84	925.00	1,680,277.49
1967-68	2,148.18	112,000.00	7,465.00	1,830.00	815,186.24	106,229.00	31,336.07	1,109.86	1,902,349.70
1968-69 ¹	2,050.00	745,750.00	56,535.00	1,920.00	1,192,488.53	—	362,918.01	1,277.88	8,632,130.69

Revenues Oil and Gas-Yukon Territory
(By Fiscal Year)

1963-64	—	23,500.00	—	30.00	6,610.00	—	—	—	413,601.21
1964-65	25.00	12,500.00	—	—	13,220.00	—	—	—	25,495.00
1965-66	—	—	—	—	13,220.00	—	—	—	19,749.89
1966-67	—	19,250.00	225.00	—	25,865.00	—	—	—	92,098.05
1967-68	—	9,750.00	—	70.00	11,888.25	—	—	—	185,069.82
1968-69 ¹	—	80,200.00	875.00	330.00	2,809.25	—	—	—	333,765.10

Grand Total Revenues-Oil and Gas
Northwest Territories and Yukon Territory
(By Fiscal Year)

1963-64	\$1,888,078.96	1965-66	\$6,272,298.44	1967-68	\$2,087,419.52
1964-65	878,268.07	1966-67	1,772,237.54	1968-69 ¹	8,965,895.79
				1968-69 ²	9,100,000.00

¹10 months actual — April, 1968 to January 30, 1969

²1968-69 Fiscal Year Estimate.

Schedule of Wells 1967	— 2.50
Schedule of Wells 1968	— in preparation
Oil and Gas Statistical Report No. 1 (1920 – 1960)	— 2.50
Oil and Gas Statistical Report No. 2 (1961-1965)	— in preparation
Economics of Oil and Gas Development in Northern Canada	— 2.50
Technical Reports Available for Inspection 1968 (Released geological and geophysical reports on Canada Lands submitted by oil operators: Reports for inspection are available only in Calgary, office of Oil Conservation Engineer).	

SOURCES OF INFORMATION

Information on northern resources activities can be obtained from the Chief, Oil and Mineral Division, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa. All cores and samples from wells drilled on Canada lands are stored at the Institute of Petroleum and Sedimentary Geology, 3303-33rd St., N.W., Calgary, Alberta. Specialized and technical literature pertaining to Northern Canada can be purchased or perused at the following government agencies:

- (a) Northern Co-ordination and Research Centre, or Library, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa, Ontario.
- (b) Department of Energy, Mines and Resources
 - 1. Geological Survey of Canada – Ottawa, Ontario Vancouver, B.C.
Institute of Petroleum and Sedimentary Geology – Calgary, Alberta.
 - 2. Dominion Observatories Branch – Ottawa, Ontario
 - 3. Marine Sciences Branch Bedford Oceanographic Institute – Dartmouth, N.S.
 - 4. Surveys and Mapping Branch – Ottawa, Ontario
- (c) Defence Research Board Scientific Information Service
- (d) Department of Transport
 - 1. Marine Works Branch – Ottawa, Ontario
 - 2. Marine Operations Branch – Ottawa, Ontario
 - 3. Telecommunications and Electronics Branch – Edmonton, Alberta Ottawa, Ontario
 - 4. Civil Aviation Branch – Winnipeg, Manitoba
 - 5. Meteorological Branch – Toronto, Ontario
- (e) Arctic Institute of North America – Montreal, Quebec

(f) National Research Council – Ottawa, Ontario

(g) The following Brochures may be available in some Public Libraries:

- i Guide to Northern Non-Renewable Resources
- ii Communication and Transportation Facilities Queen Elizabeth Group – Arctic Islands
- iii Resource Management Division – Responsibilities and Administration
- iv Oil and Gas Canada Lands – Volume No. 2
- v Oil and Gas Canada Lands – Edition No. 3
- vi Oil and Gas in the Yukon and Northwest Territories – Edition No. 4

INFORMATION AND PROCEDURES CONCERNING OPERATIONS ON CANADA LANDS

Certain federal agencies are concerned with exploration on Canada lands and must be notified prior to the commencement of any exploration activity. The operator or permittee – not the contractor is responsible for providing the requisite advance notice of planned programs to these agencies by writing direct to them.

For offshore programs the agencies that must be informed with respect to each and every program, in addition to the Oil and Mineral Division, are: the appropriate Maritime Commander in the Department of National Defence, the Aids to Navigation Division of the Department of Transport; and, in the case of seismic programs, the appropriate Regional Director of the Department of Fisheries. In the case of the Hudson Bay region, operators must also inform the National Research Council of proposed operations. Circumstances may be such that other agencies should be notified as well, and these are listed on the following pages, together with the names of persons who can be of assistance. For example, since operators are responsible for any damage they may cause to underwater commercial cables, it is recommended that they contact the Canadian Hydrographic Service for cable-lay data covering the area over which the work is to be performed. Similarly, Customs and Excise should be contacted by the importing company if vessels or equipment are to be brought in from abroad.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

1. Pursuant to Section 52, “Notices of Commencement of Exploratory Work” must be filed 15 days prior to commencement of proposed programs on the Mainland and Arctic Islands, and 45 days prior to commencement of exploratory work on offshore areas with the,

Oil Conservation Engineer,
Oil and Mineral Division,
3303 – 33rd St., N.W.,
Calgary, Alberta.

Phone: 403-284-2201

2. Information and assistance may be obtained from:

Chief,
Oil and Mineral Division,
Northern Economic Development Branch,
Department of Indian Affairs and Northern Development,
400 Laurier Avenue West,
Ottawa 4, Ontario.

Name : Dr. H.W. Woodward,
Phone: 992-5179

3. Advice on operational matters may be obtained from:

Operations Geologist,
Oil and Mineral Division
Northern Economic Development Branch.

Name: S.A. Kanik
Phone: 992-2279

4. Canadian Wildlife Service — This service discharges Federal responsibility in regard to wildlife. Information such as the locations of migratory bird sanctuaries may be obtained from:

Director,
Canadian Wildlife Service,
Department of Indian Affairs and Northern Development,
400 Laurier Avenue West,
Ottawa, Ontario.

Attention: N.G. Parret
Phone: 992-5305

DEPARTMENT OF FISHERIES

Resource Development Service

Advance notice of 90 days is required before the start of a marine seismic survey involving the use of high explosives, in the event that qualified observers are needed. Nominal advance notice is required before the start of a seismic survey in which a source of acoustical energy other than high explosives is to be used. This Department must also be informed of any offshore drilling program prior to its commencement.

Written notices should be sent to the appropriate Regional Director with a copy to:

Director,
Resource Development Service,
Dept. of Fisheries,
Sir Charles Tupper Building,
Ottawa 8, Ontario.

Name: K.C. Lucas
Phone: 997-4597

Information regarding the Department's requirements can also be obtained from:

Assistant Director,
Resource Development Service.

Name: E.W. Burrige
Phone: 997-4526

The address of the Regional Director responsible for all fresh water lakes in the Northwest Territories and Yukon is:

R.N. Gordon,
114 Gary Street,
Winnipeg 1, Manitoba.

Phone: 204-946-8101

DEPARTMENT OF NATIONAL DEFENCE

Maritime Commanders

The appropriate Office of Maritime Command requires 45 days advance notice in writing of any exploration program proposed for the offshore. Relevant information will be supplied the operator on a need-to-know basis. Approval must be obtained from the Department before the commencement of work.

Operations in the Atlantic Ocean, including the Gulf of St. Lawrence, the Labrador Sea, Hudson Bay, and Arctic waters east of longitude 105° West are handled by the office of:

Commander, Maritime Command,
Dept. of National Defence,
F.M.O., HMC Dockyard,
Halifax, Nova Scotia.

Operations off the west coast and in Arctic waters west of longitude 105° West are handled by the office of:

Maritime Commander (Pacific),
Dept. of National Defence,
F.M.O., HMC Dockyard,
Victoria, British Columbia.

DEPARTMENT OF TRANSPORT

Aids to Navigation Division

At least 60 days notice is required by this Division before the commencement of any offshore exploration program, in order that appropriate local Notices to Shipping and national Notices to Mariners may be issued. These Notices are subsequently copied into related foreign publications. The Division also indicates the requirement for any aids to navigation devices that may be necessary for the program.

Advance notice of 90 days is required in any case where an exploration program involves the territorial sea, in order for approval to be granted under the Navigable Waters Protection Act.

All communications on these matters should be directed to:

Chief, Aids to Navigation,
Marine Works Branch,
Department of Transport,
Ottawa, Ontario.

Name: J.N. Ballinger
Phone: 992-2736

In addition, there are a number of Departmental officers who may be contacted in the field should the need arise. Their titles and addresses are given below:

District Marine Agent,
Department of Transport,
P.O. Box 310, Uppertown,
Quebec 4, Quebec.
(This office handles Hudson Bay)

District Manager,
Department of Transport,
P.O. Box 155,
Hay River, N.W.T.

Marine Operations Branch

This agency directs the operations of the Canadian Coast Guard which has major responsibilities in two areas of concern to offshore operations: support of shipping in ice-congested waters, and marine search and rescue.

If operations are being contemplated for areas where ice may be a problem and where ice-breaker or other support may be desired, there should be consultation with the Director of Marine Operations as long in advance as possible. This is particularly important in the case of Arctic or Hudson Bay operations where the planning of ice-breaker disposition is usually done six months in advance of the season.

Further information and assistance may be obtained from:

Director,
Marine Operations Branch,
Dept. of Transport,
Ottawa, Ontario.

Name: A.H.G. Storrs
Phone: 992-4209

Marine Regulations Branch

The Branch includes the Steamship Inspection Division and the Nautical and Pilotage Division. The responsibilities of the former Division include inspection and certification of vessels under the Canada Shipping Act, oil pollution by ships, and safety of life at sea. The responsibilities of the latter Division include registration of shipping, marine accident investigation and inquiries, salvage, marine personnel, and navigation safety matters. This last includes the establishment of restricted navigation areas and the routing of ships.

Further information and assistance can be obtained from:

Director,
Marine Regulations Branch,
Dept. of Transport,
Ottawa, Ontario,

Name: R.R. Macgillivray
Phone: 992-8892

Meteorological Branch

Data regarding such matters as weather and ice conditions are compiled by the Branch and are available to operators and contractors on request. Information concerning this and relevant matters can be obtained through:

Meteorological Liaison Officer,
Dept. of Transport,
No. 3 Temporary Building,
Ottawa, Ontario.

Name: A.G. MacVicar
Phone: 992-4217

The position of Meteorological Liaison Officer is filled on a rotational basis and the name of the incumbent may change shortly for this reason.

Request for information on climatology, weather forecasting, meteorological instruments and research may be obtained by writing to:

Director,
Meteorological Branch,
Dept. of Transport,
315 Bloor Street West,
Toronto 5, Ontario.

Name: J.R.H. Noble

GOVERNMENT TELECOMMUNICATIONS POLICY AND ADMINISTRATION BUREAU

Radio Regulations Division

The powers, duties and functions of the Minister of Transport under the Radio Act have been transferred to the Minister designate of the proposed Department of Communications. This action involves the Government Telecommunications Policy and Administration Bureau under which the Radio Regulations Division is established.

Any company contemplating the use of radio communications in their offshore exploration activities should contact:

Controller,
Radio Regulations Division,
Government Telecommunications Policy and Administration Bureau,
Ottawa, Ontario.

Name: W.J. Wilson
Phone: 992-0804

Advice in determining communication requirements and the necessary application for licence may also be obtained from:

Superintendent of Radio Authorization and Enforcement,
Radio Regulations Division.

Name: A.G.E. Argue
Phone: 992-3427

DEPARTMENT OF ENERGY, MINES AND RESOURCES

Marine Sciences Branch

Every operator planning to undertake an offshore program is responsible for ascertaining the disposition of commercial cables within the area involved. Information on commercial cable lays can be obtained from:

Canadian Hydrographic Service,
Marine Science Branch,
Dept. of Energy, Mines and Resources,
Ottawa 3, Ontario.

Attention: J. Bruce
Phone: 994-9487

NATIONAL RESEARCH COUNCIL

Space Research Facilities Branch

Operators planning offshore activities in the Huddson Bay region must inform the following agency of the National Research Council well in advance since rockets are fired on a year round basis from the Churchill Research Range:

Head,
Range Section,
Space Research Facilities Branch,
National Research Council,
Ottawa 7, Ontario.

Name: J.F. Aitken
Phone: 993-9225

Operators active in the Hudson Bay region are also required to co-ordinate their field activities with:

General Superintendent,
Churchill Research Range,
National Research Council,
Fort Churchill, Manitoba.

Name: J.H. Brandy
Phone: via The Pass, Fort Churchill, No. 123

Rockets are also launched from time to time from the facility at Resolute Bay, N.W.T. and operators with exploration work planned for this vicinity are urged to coordinate their activities with the National Research Council.

DEPARTMENT OF NATIONAL REVENUE

Customs and Excise

The Port Administration Division administers that portion of the Canada Shipping Act that relates to the coasting trade. In this connection, any company importing ships or specialized plant and equipment for exploration work Canada's seacoasts may obtain information, assistant and other contacts as may be necessary in Customs and Excise from:

Director,
Port Administration Division,
Customs and Excise,
Dept. of National Revenue,
Ottawa, Ontario.

Name: A. Senecal
Phone: 992-4952

DEPARTMENT OF MANPOWER AND IMMIGRATION

Canada Immigration Division

Enquiries should be directed to:

Department of Manpower and Immigration,
Canada Immigration Division,
Admission Section,
Ottawa, Ontario.

Phone: 992-3305

The Calgary office of the Department of Immigration can answer any queries regarding entry into the Northwest Territories. The Vancouver office is responsible for entry into the Yukon Territory.

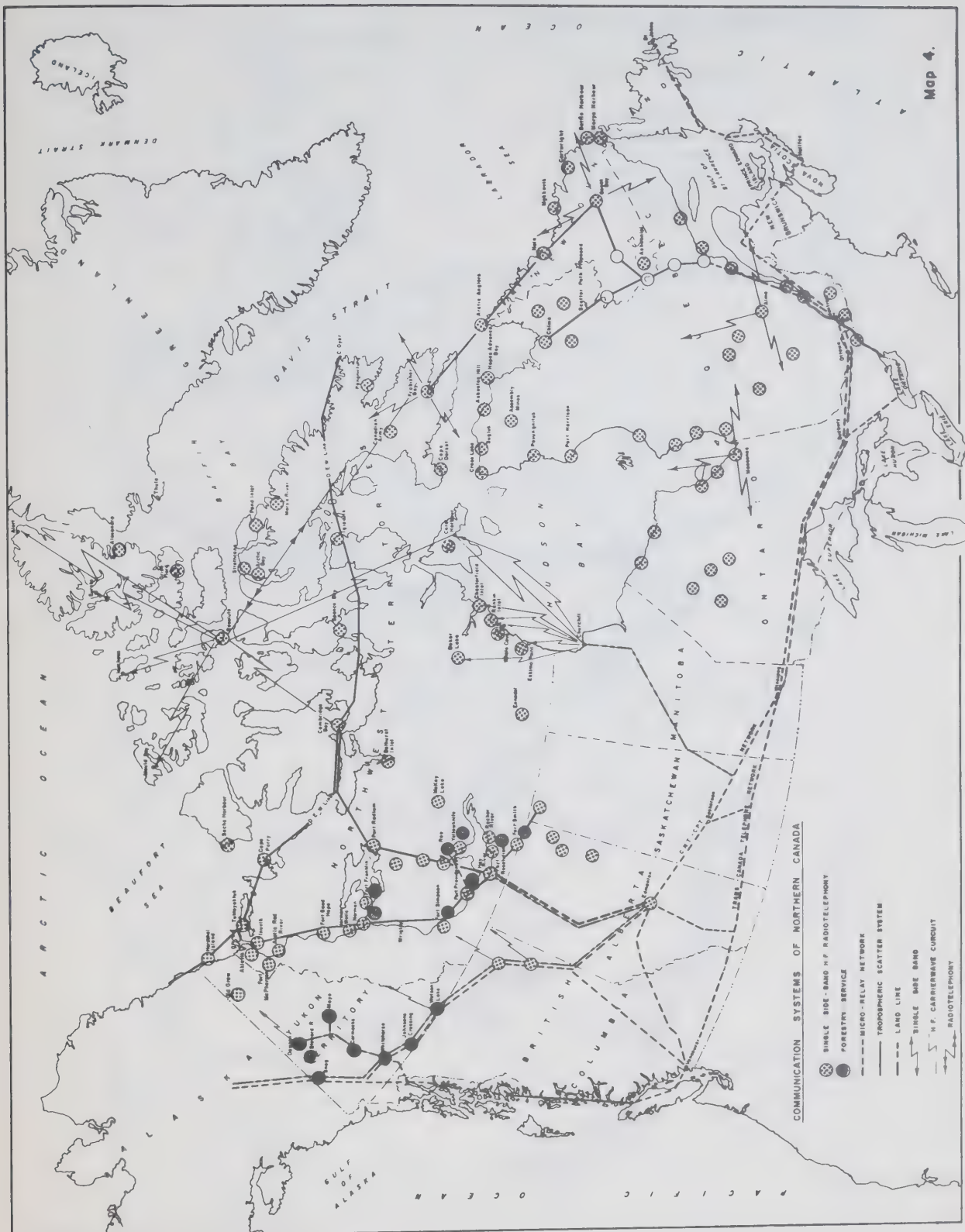
At Tuktoyaktuk, a local R.C.M.P. officer is also a representative of the Department of Manpower and Immigration and can clear entry into Canada via Tuk.

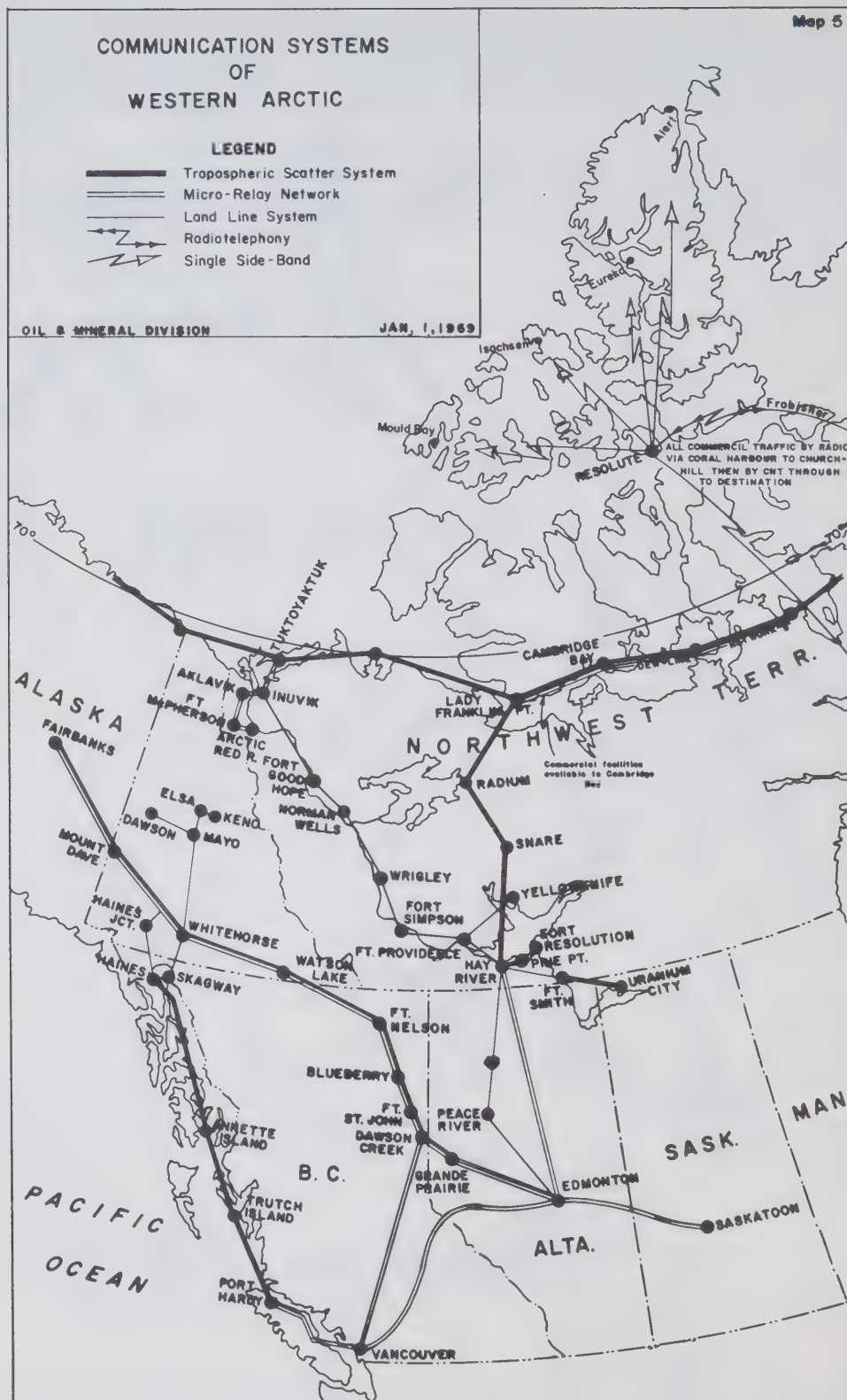
At Inuvik, the Customs Department has a Departmental representative and he can be contacted by telephone if prior arrangements are necessary. There is no representative at Aklavik; if you foresee that a seismic crew will prefer to land at Aklavik, then arrangements must be made with the Inuvik representative.

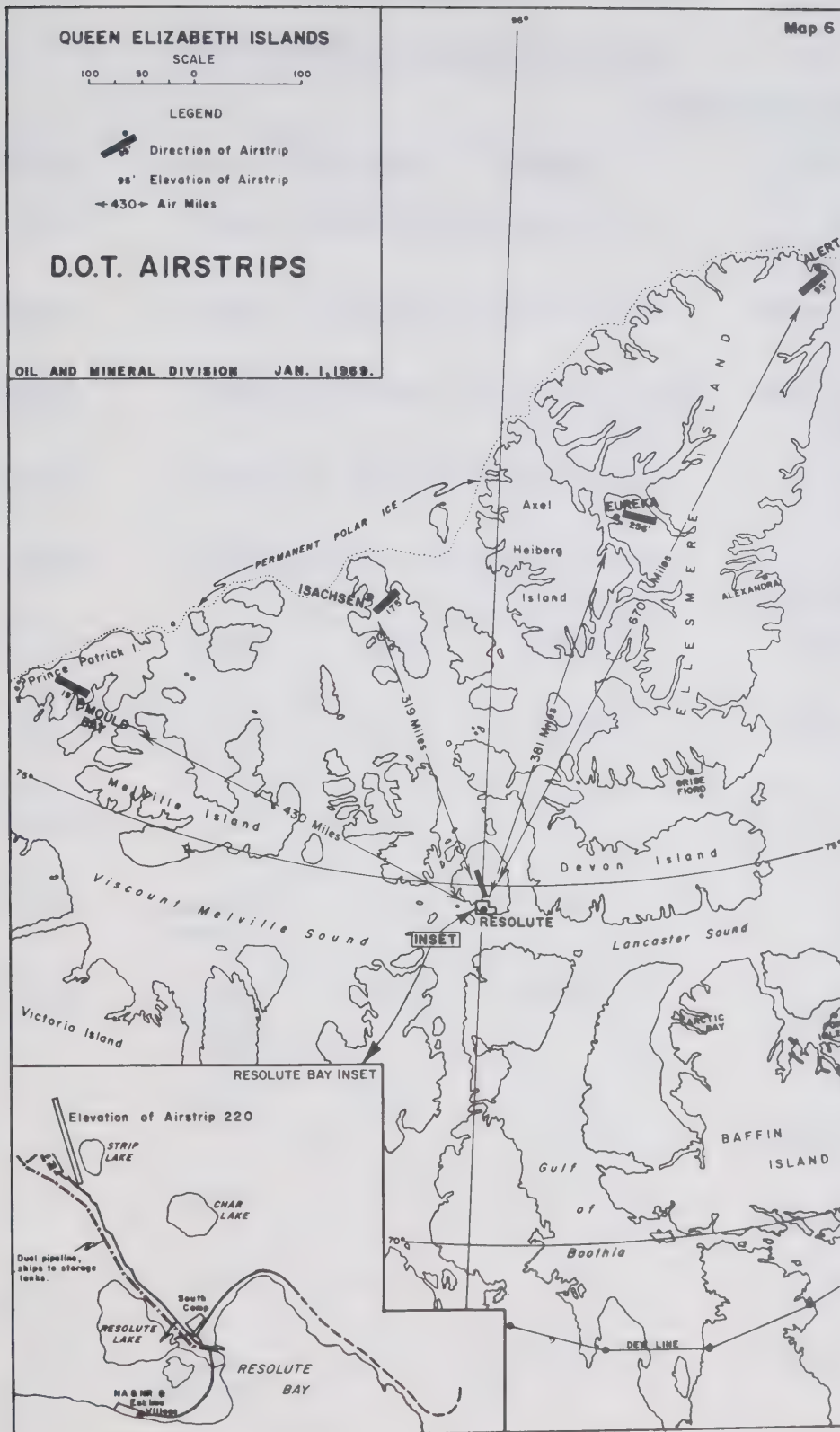
COMMUNICATIONS

The brochure, "Communications and Transportation Facilities, Queen Elizabeth Group, Arctic Islands", contains a detailed summary of communication and transportation facilities in the Arctic Islands. Please refer to it also for all basic information on accommodation at Resolute and the satellite weather stations.

Voice communication facilities are available from southern Canada to Resolute via Frobisher Bay, Maps Nos. 4, 5, and 6 contain relevant data on trunk lines and communications systems of northern Canada.







APPENDIX I

WELLS COMPLETED OR ABANDONED IN 1968

NORTHWEST TERRITORIES

<u>NAME OF WELL</u>	<u>SPUDDED</u>	<u>COMPLETED</u>	<u>STATUS</u>	<u>TOTAL DEPTH</u>
Canso et al Cameron Hills H-34	2-12-68	31-12-68	D & A	3,198
CDR Chevron Mills Lake C-12	7-1-68	19-1-68	D & A	2,210
CDR Chevron Mills Lake L-10	21-1-68	10-2-68	D & A	2,060
Dome et al Celibeta C-77	14-12-67	8-1-68	D & A	4,965
Dome et al Island River E-56	8-2-68	9-3-68	D & A	7,702
GPD Noel Mills Lake P-52	29-2-68	11-3-68	D & A	1,425
GPD Noel Mills Lake B-41	30-1-68	15-2-68	D & A	1,375
GPD Noel Mills Lake L-41	18-2-68	26-2-68	D & A	1,081
HB Cameron Hills A-05	21-1-68	24-2-68	Suspended Gas Well	4,966
Imp. Goose Island No. 19 E-67	30-7-68	24-8-68	Water Injection Well	2,735 T.D. 2,098 P.B.D.
Imp. Goose Island No. 20 L-57	12-7-68	28-7-68	Oil Well	2,012
Imp. Goose Island No. 21 E-57	30-6-68	10-7-68	Oil Well	1,664
IOE Providence K-45	28-1-68	9-3-68	D & A	862
IOE Providence A-47	11-3-68	22-3-68	Thermal Observation	1,655

<u>NAME OF WELL</u>	<u>SPUDDED</u>	<u>COMPLETED</u>	<u>STATUS</u>	<u>TOTAL DEPTH</u>
Iskut Little Buffalo K-22	17-1-68	19-1-68	D & A	736
McDermott et al Mid Lake H-33	21-2-68	3-3-68	D & A	833
Pan Am A-1 Grainger J-15	10-10-68	29-10-68	D & A	2,900
Pan Am A-2 Grainger N-42	2-11-68	30-11-68	D & A	3,515
Pan Am Pointed Mountain K-45	15-9-67	8-5-68	Suspended Gas Well	13,450 T.D. 11,030 P.B.D.
Pan Am BA A-1 Spawn G-27	28-1-68	29-2-68	D & A	5,602
Placid Kakisa J-65	22-1-68	10-2-68	D & A	3,041
Placid Chevron Kakisa L-71	12-2-68	25-2-68	D & A	3,087
Placid Chevron Gull Creek F-46	26-2-68	10-3-68	D & A	3,065
Placid Chevron N.E. Tathlina D-50	13-3-68	28-3-68	D & A	2,650
Placid Wood W. Tathlina K-48	27-2-68	10-3-68	D & A	3,311
Shell Kakisa Lake C-04	30-12-67	21-1-68	D & A	2,661
Shell Trout Lake O-41	15-12-67	1-2-68	D & A	7,308
Shell Pan Am Two Islands O-28	24-1-68	17-2-68	D & A	2,460
Shell Beaver Lake M-29	13-2-68	25-2-68	D & A	1,674
Shell Union Pan Am Tetcho J-12	8-2-68	1-3-68	D & A	5,586
Shell Imperial Foetus LK F-60	21-2-68	5-3-68	D & A	2,920

<u>NAME OF WELL</u>	<u>SPUDED</u>	<u>COMPLETED</u>	<u>STATUS</u>	<u>TOTAL DEPTH</u>
Shell Beaver Lake M-39	25-2-68	29-2-68	D & A	611
Shell Beaver Lake M-39A	29-2-68	6-3-68	D & A	990
Shell Grumbler F-07	7-3-68	29-3-68	D & A	2,290
UOHL Trout River O-80	27-2-68	17-3-68	D & A	4,500
Union Pan Am Trainor H-28	23-1-68	22-2-68	D & A	7,232
YUKON TERRITORY				
Canoe River Chance Y.T. J-19	17-12-67	16-2-68	Suspended Gas Well	4,740
Canoe River East Chance Y.T. C-18	27-2-68	7-4-68	D & A	5,055
Scurry N.V. East Watson Lake Y.T. G-79	8-12-67	28-1-68	D & A	3,750

NUMBER OF WELLS DRILLED IN 1968 –39

TOTAL FOOTAGE DRILLED IN 1968 –131,877

APPENDIX II

The Oil and Mineral Division is a member of the "Federal-Provincial Committee on Energy Statistics" and the "Mine Ministers Subcommittee on Oil and Gas Statistics" and together with the four western provinces and the D.B.S. has standardized all its oil and gas reporting forms. This standardization has removed duplication between government agencies and more important, industry can now process all oil and gas reporting forms from the western provinces and the Yukon and Northwest Territories on computer machines without change of programs. These forms are to be completed when applicable during the exploratory stages, and prior to production of oil and gas.

FORM NO.	TITLE OF FORM
IAND 52-90	Front Covers for Well File
IAND 52-90	Back Covers for Well File
IAND*52-90-1**	Application for a Drilling Authority
IAND*52-90.*	Well Completion Data
IAND*52-90-3**	Application to Amend a Drilling Authority
IAND*52-90-4**	Application to Change a Well Name
IAND*52-90-5**	Application to Abandon a Well or Suspend Drilling
IAND*52-90-6**	Application to Alter Condition of a Well
IAND*52-90-7	Work-over Report No.
IAND*52-90-8	Application to Commingle Production before Measurement
IAND*52-90-9	Data for Back Pressure Test on Natural Gas Wells – Monograph 7 Method
IAND*52-90-10	Data for Back Pressure Test on Natural Gas Wells – Vitter's Method
IAND*52-90-11	M.P.R. – Oil – Calculations
IAND*52-90-12	New Oil Well Report
IAND*52-90-13	New Gas Well Report
IAND 52-90-14	Well-Site Inspection Report (in pads of 25)
IAND 52-90-15	Rig Inspection Report (in pads of 25)
IAND 52-90-16	Gas Well Installation/Battery Inspection Report (in pads of 25)
IAND*52-90-17	New Service Well Report
IAND*52-90-18	Monthly Water Flood Operations Report
IAND 52-90-19	Well Card
IAND*52-90-20	Monthly Water Receipts and Disposal of Fluid Report
IAND 52-90-21	Meter Inspection Report (in pads of 25)
IAND 52-90-22	Monthly Operations Report (in pads of 25)
IAND*52-91	Notice of Commencement of Exploratory Work
IAND*52-92	Application for Authority to Drill Structure Test Hole
IAND*52-93	Report on Abandonment of Structure Test Holes
IAND*52-83	Grouping Notice
IAND*52-103**	Application for Oil and Gas Lease

*To be completed by Operator

**To be completed in triplicate; all other forms to be completed in duplicate.

All forms except IAND 52–83 and 52–103 to be submitted to the Oil Conservation Engineer, 3303–33rd St. N.W., Calgary, Alberta.

Forms IAND 52–83 and 52–103 to be submitted to the Oil and Mineral Division, 400 Laurier Avenue West, Ottawa 4, Ontario

APPENDIX III

The following forms have been issued pursuant to the "Canada Oil and Gas Land Regulations" and the "Canada Oil and Gas Drilling and Production Regulations". These forms are to be completed when applicable during the production stage of oil and gas wells, and refinery operations.

FORM NO.	TITLE OF FORM
IAN 52-116-1	Monthly Production Report
IAN 52-116-2	Monthly Disposition and Crown Royalty Statement
IAN 52-116-3	Monthly Gas Gathering Statement
DBS 6511-38*	Monthly Oil Pipeline Gathering Operations Statement
IAN 52-116-5	Monthly Crude Oil and Condensate Purchasers' Statement
IAN 52-116-6	Monthly Gas Plant Statement
DBS 6511-37*	Monthly Natural Gas Distributors Statement
IAN 52-116-8	Monthly Gas Processing Plant Products Statement
IAN 52-116-9	Monthly Liquefied Petroleum Gas Purchasers Statement
IAN 52-116-10	Monthly Refinery Operations Report
IAN 52-116-11	Monthly Gas Injection Operations Report
IAN 52-116-12	Statement of Nomination and Estimated Requirement for Crude Oil, Condensate and Pentanes Plus

NOTE: (a) All forms to be completed by Operator.

*(b) Please complete three copies of Forms 6511-31 and 6511-38. Submit original and one copy to Oil and Mineral Division and one copy to Oil Conservation Engineer, Department of Indian Affairs and Northern Development, Calgary, Alberta. One copy is submitted to Dominion Bureau of Statistics by Oil and Mineral Division.

(c) Please complete 2 copies of all other forms; submit original to Oil and Mineral Division, Ottawa, and one copy to the Oil Conservation Engineer, Department of Indian Affairs and Northern Development, Calgary, Alberta.

APPENDIX IV

Selected geological references applicable to geological provinces in northern Canada are listed below. References are Geological Survey of Canada publications unless otherwise noted.

Memoir 273	The Lower Mackenzie River Area G.S. Hume
Memoir 322	Stratigraphy of Middle Devonian and Older Palaeozoic Rocks of the Great Slave Lake Region, Northwest Territories A.W. Norris
Bulletin 95	Carboniferous and Permian Rocks, Southwestern District of Mackenzie P. Harker
Paper 58-2	Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains J.A. Jeletzky
Paper 58-11	Great Slave and Trout River Map Areas R.J.W. Douglas
Paper 59-11	Horn River Map Area R.J.W. Douglas, et al
Paper 61-1	Summary Account of Carboniferous and Permian Formations — Southwestern District of Mackenzie P. Harker
Paper 61-9	Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell Rivers J.A. Jeletzky
Paper 61-13	Camsell Bend and Root River Map Areas R.J.W. Douglas, et al
Paper 61-18	Geological Notes — Northern District of Keewatin W.W. Heyword

Paper 61-29	Upper Devonian Formations H.R. Belyea, et al
Paper 62-15	Middle Devonian and Older Paleozoic Formations of Southern District of Mackenzie H.R. Belyea, et al
Paper 62-33	Dahadinni and Wrigley Map Areas R.J.W. Douglas, et al
Paper 65-32	Geophysical Reconnaissance of Hudson Bay Peter Hood
Paper 66-50	Jurassic and Triassic Rocks of the Eastern Slope of Richardson Mountains Northwestern District of Mackenzie J.A. Jeletzky

ARCTIC LOWLANDS

Paper 63-44	Surficial Geology of Boothia Peninsula and Somerset, King William and Prince of Wales Islands B.G. Craig
Paper 64-47	Lower Palaeozoic Sediments of Northwestern Baffin Island H.P. Trettin

FRANKLINIAN GEOSYNCLINE

Memoir 294	Corwallis and Little Cornwallis Islands — District of Franklin, Northwest Territories R. Thorsteinsson
Memoir 309	Permian Rocks and Faunas of Grinnell Peninsula — Arctic Archipelago P. Harker, et al
Memoir 316	Triassic Stratigraphy and Faunas, Queen Elizabeth Islands, Arctic Archipelago E.T. Tozer
Memoir 330	Banks, Victoria and Stefansson Islands, Arctic Archipelago R. Thorsteinsson & E.T. Tozer

New Nomenclature for Ordovician Rock Units of the Eastern and Southern
Queen Elizabeth Islands, Arctic Canada

Wm, Kerr

Middle Ordovician to Middle Silurian Carbonate Cycle, Brodeur Peninsula,
Northwestern Baffin Island

H.P. Trettin

SVERDRUP BASIN

Memoir 320 Geology of the North Central Part of the Arctic Archipelago – (Operation
Franklin)

Y.O. Fortier, et al

Memoir 331 Geological Reconnaissance of Northeastern Ellesmere Island – District of
Franklin

R.L. Christie

Memoir 332 Western Queen Elizabeth Islands, Arctic Archipelago

E.T. Tozer & R. Thorsteinsson

Paper 60-7 Summary Account of Structural History of the Canadian Arctic Archipelago
since Precambrian Time

R. Thorsteinsson, et al

Paper 63-30 Mesozoic and Tertiary Stratigraphy, Western Ellesmere Island and Axel
Heiberg Island

E.T. Tozer

Paper 66-34 Lower Triassic Tar Sands of Northwestern Melville Island, Arctic Archipelago

H.P. Trettin, et al

Paper 66-55 Ordovician Stratigraphic Section at Daly River, Northeast Ellesmere Island

B.S. Norford

Paper 67-27 Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada.
Proterozoic and Cambrian

J.Wm. Kerr

Paper 67-27 pt II

Stratigraphy of Central and Eastern Ellesmere Island, Arctic pt II. Ordovician

J. Wm. Kerr

Paper 67-27 pt III (in press)

Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada pt. II.
Upper Ordovician, Silurian and Devonian

J. Wm. Kerr

G.S.C. Bulletin (in press)

Pre-Mississippian Rocks of Northern Axel Heiberg and Northwestern
Ellesmere Island, Arctic Archipelago

H.P. Trettin

FOXES BASIN

Paper 62-35

Notes with Map 3—1958 and Map 4—1958 — Fury and Hecla Strait; Foxe
Basin North

R.G. Blackadar

Geog. Bull. 4

The Islands in Foxe Basin; Geog. Br. Department of Mines and Technical
Surveys.

PP. 1-29

Paper 64-47

Lower Palaeozoic Sediments of Northwestern Baffin Island, District of
Franklin

H.P. Trettin

HUDSON BAY BASIN AND LOWLANDS

Paper 48-23

Flights over the North Magnetic Pole, the Mainland between the Arctic Coast,
Great Slave Lake and Hudson Bay

Y.O. Fortier

Paper 59-13

Aeromagnetic Surveys Across Hudson Bay from Churchill to Coral Harbour
and Churchill to Great Whale River

M.E. Bower

Paper 60-20

Belcher Islands

G.D. Jackson

- Paper 63-48 Sedimentology of Hudson Bay
R.J. Leslie
- Paper 67-24 Stratigraphic sections of Palaeozoic Rocks on Prince of Wales and Somerset Islands, District of Franklin, Northwest Territories
R.L. Christie
- Paper 67-60 Geology of the Hudson Bay Lowlands Operation Winisk
B.V. Sanford, A.W. Norring, H.H. Bostock

ARCTIC COASTAL PLAINS AND CONTINENTAL SHELF

- Paper 63-22 Marine Geology, Eastern Part of Prince Gustaf Adolf Sea
J.L. Marlowe, et al

EAGLE PLAIN & NORTHERN YUKON

- Memoir 247 Physiography of the Canadian Cordillera with Special Reference to the Area North of the Fifty-fifth Parallel
H.S. Bostock
- Paper 61-9 Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell Rivers
J.A. Jeletzky
- Paper 63-39 Reconnaissance of the Ordovician and Silurian Rocks of Northern Yukon Territory
B.S. Norford
- Paper 66-39 Descriptions of Devonian Sections in Northern Yukon and Northwestern District of Mackenzie
A.W. Norris
- Paper 67-53 Reconnaissance Devonian stratigraphy of Northern Yukon and Northwestern District of Mackenzie
A.W. Norris
- Bulletin of Canadian Petroleum Geology March 1965 — Vol 13 No. 1 Lower Paleozoic Salt, Canadian Arctic Islands
R.H. Workum
- Bulletin of Canadian Petroleum Geology Sept. 1964 — Vol 12 No. 3 Precement Structures in the Arctic Islands
Don B. Gould, George de Mille

activities

1969



north of 60

oil and gas



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Ø32

northern economic
development branch
department of indian affairs
and northern development
government of canada

OIL AND GAS, NORTH OF 60

A report of Activities in 1969, of the
Oil and Gas Industry
In the Yukon Territory and Northwest Territories

1969

(Edition No. 6)

Compiled By
Oil and Gas Section
Oil and Mineral Division
Northern Economic Development Branch

Canada
DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

Issued under the Authority of the
Honourable Jean Chrétien, P.C., M.P., B.A., LL.L
Minister of Indian Affairs and Northern Development
Ottawa, Canada

January 1, 1970

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Information Canada
Ottawa, 1970

Cat. No.: R71-6/1969

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INTRODUCTION

Canada North of 60 has entered a major new stage in oil and gas exploration. In 1969 most of the exploration activity indicators doubled over the previous years. Spurred by large oil discoveries on the Alaska North Slope, and the lack of new oil discoveries in Alberta, oil companies are converging on large untested sedimentary basins in the Territories and Arctic Islands.

Oil and Gas Permits in effect in the North as of December 31, 1969 covered approximately 439 million acres as follows: 112 million acres on the Northwest Territories Mainland; 29 million in the Yukon; 258 million in the Arctic Islands and Arctic offshore North of 70° North latitude; and over 39 million acres offshore in the marine areas, south of 70° North latitude. Oil and Gas Leases in effect in the North as of December 31, 1969 covered over 3 million acres; approximately 2.5 million in the Northwest Territories Mainland and 186 thousand in the Yukon.

Figure No. 1 graphically illustrates the total acreage held under oil and gas permits at each year's end for the last ten years.

Map No. 1 illustrates the extent of Canada lands under permit and lease North of 60 at the end of 1969.

Expenditures for oil and gas exploration in 1969 are in the order of 56 million dollars. Approximately one-half of this was spent on geophysical exploration.

How much oil and gas will be found North of 60 is, of course, unknown. In Canada North of 60, about 450,000 square miles are underlain by sedimentary rocks ranging in age from Cambrian to Tertiary that may be considered to be potentially productive of oil and gas. Map No. 2 outlines the areal extent of the major geologic provinces of Canada's North. Excluding all sediments in areas where the total section is less than 1,000 feet thick as well as those at depths exceeding 16,000 feet, at present believed to be only marginally attractive, there are nearly 1,000,000 cubic miles of sedimentary rocks. Applying a factor of 50,000 barrels of oil and 300 million cubic feet of gas per cubic mile of sediment, the average established in the United States where many basins have been subject to rather complete exploration, possible reserves North of 60 may be 50 billion barrels of oil and 300 trillion cubic feet of gas. A comparison of the sedimentary areas, volumes and proven oil and gas reserves in the Western Provinces, the Yukon, Northwest Territories and Arctic Islands is given in Table 1. For discussion on potential reserves of the area North of 60, please refer to the Chapter on "Reserves".

From the standpoint of oil and gas, Canada North of 60 is virtually unexplored. Since 1947, generally considered to be the beginning of the modern era for oil and gas exploration in Western Canada, there has been one exploratory well drilled for 1,400 square miles of sedimentary area on the Mainland North of 60. In the Arctic Islands, the exploratory drilling density is one well for every 60,000 square miles. This contrasts with the Western Provinces where the density of exploratory drilling is one well for every 40 square miles.

Norman Wells is the only producing oil field North of the 60th parallel in Canada. The field was discovered in 1920, but intensive commercial development did not take place until World War II. During 1969 oil was produced at an average rate of approximately 2,400 barrels daily.

Several significant gas flows and a few good oil shows have been encountered in other areas, but these finds have not been commercially exploited as yet, due to lack of suitable market outlets within economic reach.

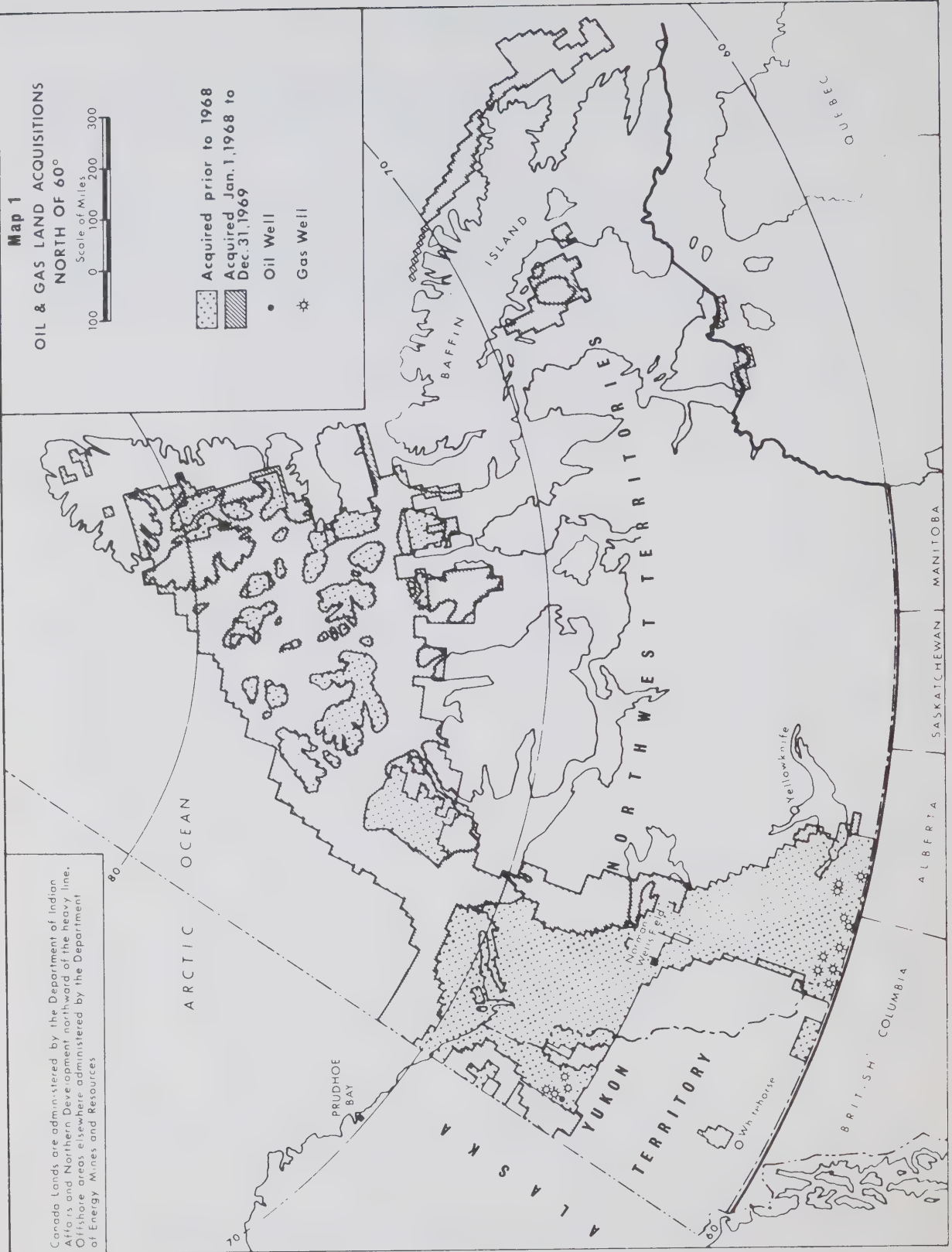
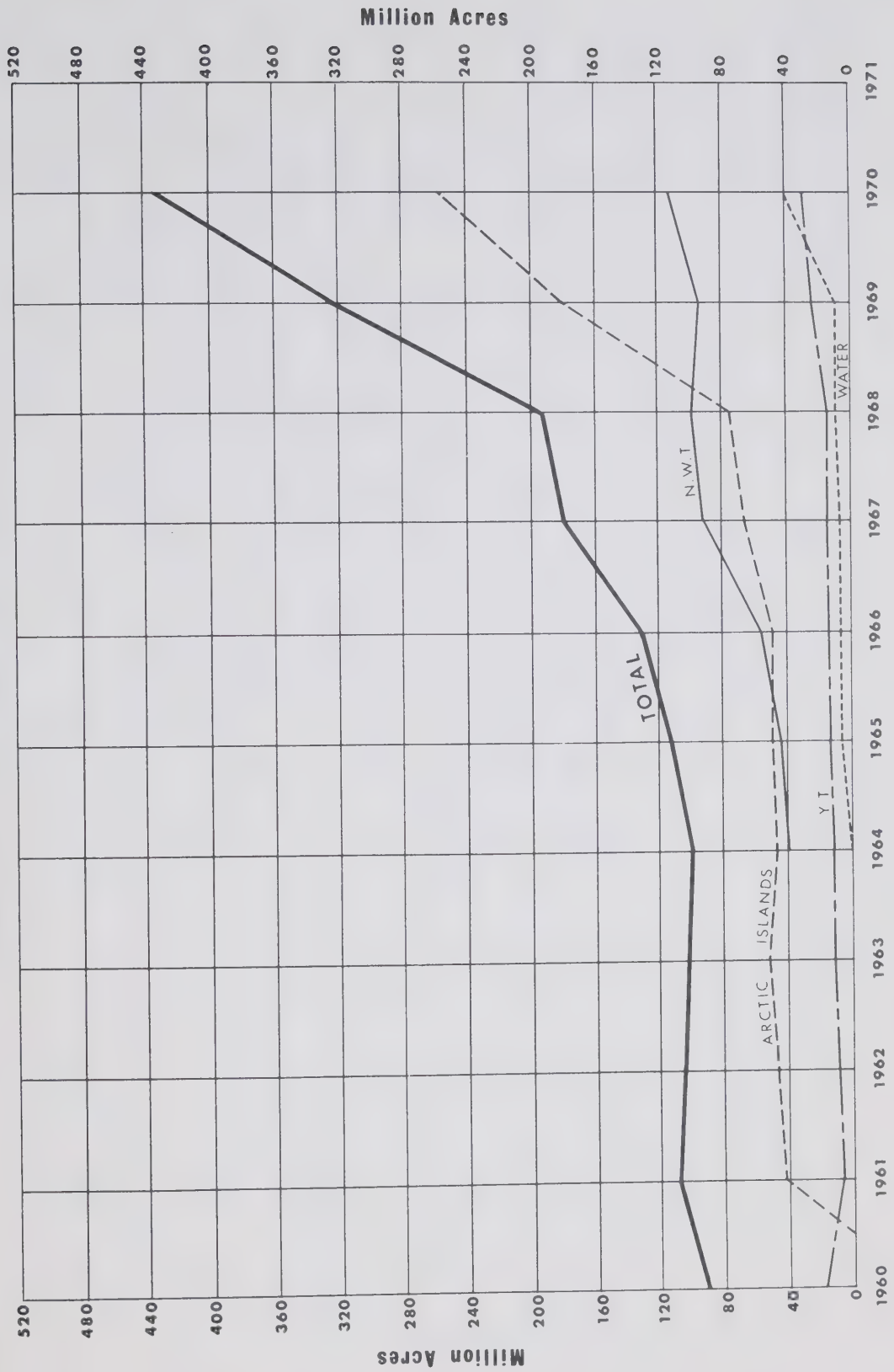
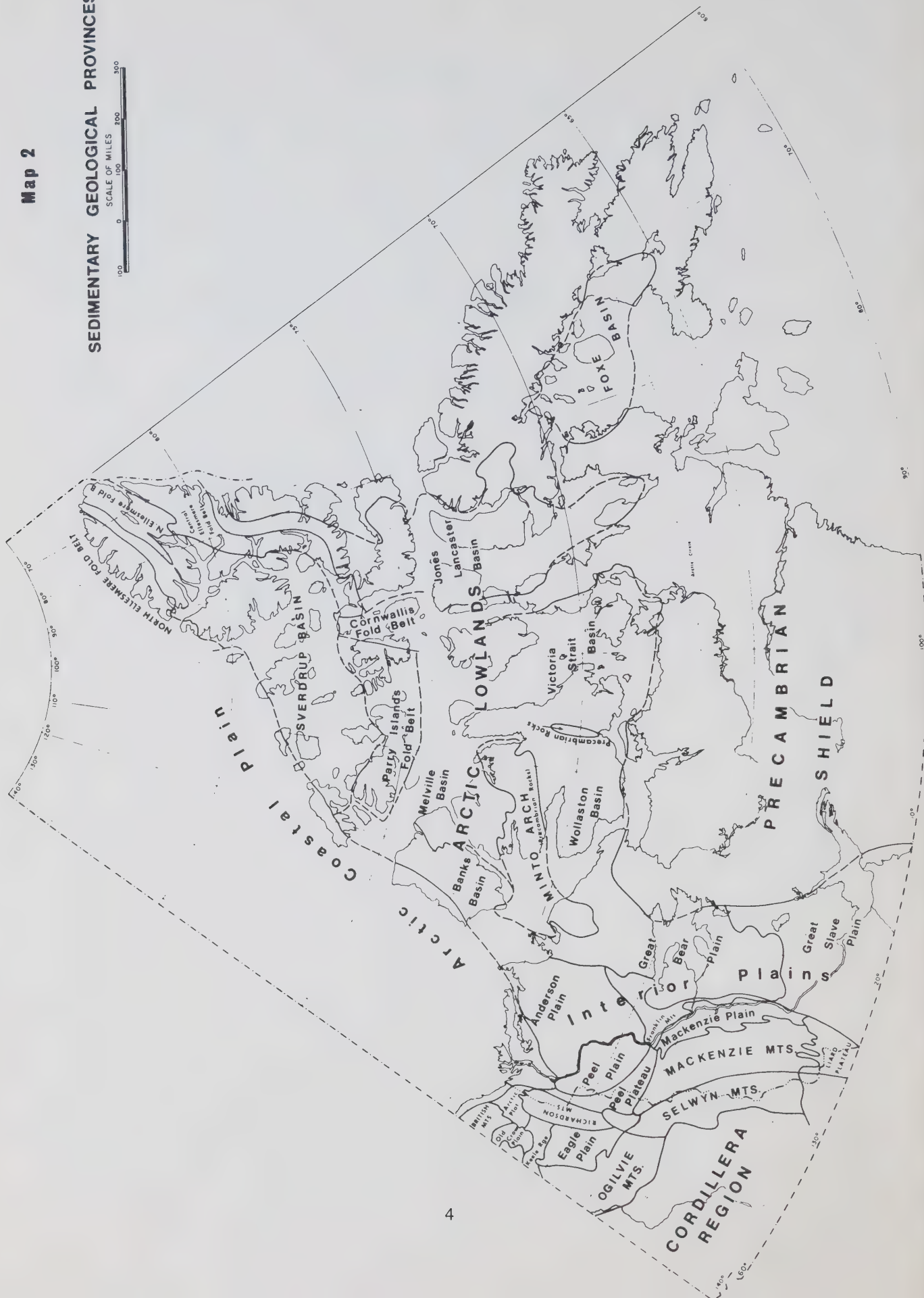
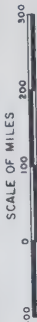


Fig. 1
ACREAGE HELD UNDER OIL & GAS PERMIT
 YUKON TERRITORY AND NORTHWEST TERRITORIES



Map 2

SEDIMENTARY GEOLOGICAL PROVINCES



5

*Source: Canadian Petroleum Association

Canada North of 60 encompasses one of the largest remaining unexplored sedimentary geological provinces in the world. With the increase of large scale exploration over the next five to ten years, the area can become one of the truly large, prolific petroleum areas of the western hemisphere.

All aspects of oil and gas operations in the Yukon and Northwest Territories are administered by the Department of Indian Affairs and Northern Development, specifically by the Oil and Gas Section of the Oil and Mineral Division. It is the intent of the Department to provide for the orderly exploration and exploitation of oil and gas, thereby achieving benefits of a local nature to the specific areas involved and to the people of Canada in general through the attendant revenues accruing to the Crown.

The Minister and officers of the Department of Indian Affairs and Northern Development who are responsible for administering oil and gas resources in the Northwest Territories and Yukon, and northern offshore areas, are

Minister	— Hon. Jean Chrétien, P.C.
Deputy Minister	— H.B. Robinson
A/Assistant Deputy Minister (Northern Development)	— A.D. Hunt
Acting Director Northern Economic Development Branch	— A.J. Reeve
Chief, Oil and Mineral Division	— Dr. H.W. Woodward
Administrator, Oil and Gas	— R.R. McLeod
Supervisor, Geological Operations Unit	— S.A. Kanik
Supervisor, Geological Evaluation Unit	— J. Hawryszko
Supervisor, Land Unit	— P. Sullivan
Oil Conservation Engineer	— B.H.J. Thoms, Calgary, Alberta.

CURRENT LAND ACTIVITY

In 1969, the high Arctic continued to be the "glamour" area North of 60°, with continued filing in the Arctic Ocean offshore and in the more northerly islands of the Archipelago. The first evidence of the intensity of industry interest was shown in the very successful Crown Reserve offering in late January 1969, which yielded cash bonuses of \$3,717,991.27 and work commitments of \$23,941,715.68. The Melville Island drilling program of Panarctic Oils Ltd., the Mackenzie Delta drilling program of Imperial Oil Ltd. and the S.S. Manhattan's experimental passage through the Archipelago served to maintain the industry's interest at a high level throughout the year. Table No. 2, summarizing the permit and lease holdings North of 60° points up the intensity of the overall activity and the range of this activity in the North is shown in the land map (Map No. 1).

In the January 1969 oil and gas permit sale, five work bonus blocks in the Mackenzie Delta Area of the Beaufort Sea, received work bonus tenders ranging from \$6.15 to \$24.66 per acre with an average of over \$13.30 per acre, and five work bonus blocks in Peel Plateau area at tenders ranged from \$1.00 to \$8.00 per acre with a \$5.00 per acre average.

Industry also continued its drive for representation in the Arctic, acquiring through filings, an additional 70 million acres in the Arctic Islands. Several companies secured more representative holdings by acquisitions through farmouts and direct purchases. This latter activity was fairly uniformly spread through the industry, but was primarily used by the larger exploration companies with acquisition by filings used chiefly by the smaller companies. As a result this high level of activity greatly increased aggregate industry holdings in the relatively unexplored geological areas flanking the Sverdrup Basin.

TABLE NO. 2

**Number of Permit and Leases and Relevant
Acreage — 31 December, 1969**

<u>Permit</u>	<u>No. of Tracts</u>	<u>Acreage</u>
N.W.T. Mainland	2,425	112,272,315
Y.T. Mainland	675	29,413,623
Arctic Islands ⁽¹⁾	5,211	258,045,966
Arctic Coast Marine ⁽²⁾	839	38,896,436
TOTAL PERMITS	9,150	438,628,340
Lease		
N.W.T. Mainland	412	2,675,335
Y.T. Mainland	55	186,092
Arctic Islands ⁽¹⁾	—	—
Arctic Coast Marine ⁽²⁾	—	—
TOTAL LEASES	467	2,861,427

(1) All areas North of 70°, onshore and offshore.

(2) All areas South of 70°, covered by seacoast waters.

Concurrently with the high Arctic interest, several new land plays were initiated in frontier areas — offshore in the Davis Strait (east of Baffin Island); the Foxe Basin (north of the Hudson Bay and west of Baffin); and the small sedimentary basin in the southern Yukon Territory north of Whitehorse. This activity in the frontier areas excluding the Yukon was largely responsible for the 255% increase in the marine holdings south of 70°, pushing the total to over 38 million acres. Although small increases, in the aggregate holdings in the Yukon Territory and Northwest Territories, (11 and 16 per cent respectively) were noted, the western Canadian sedimentary basin did not receive the intensive land interest noted in the Arctic and frontier areas, largely because of the scarcity of open land.

The 30% increase in leaseholdings was expected as the permit holdings south of 65° are rapidly reaching maturity and must be converted to lease or dropped. A similar increase is expected during 1970.

OIL AND GAS PRODUCTION AND CONSERVATION ACT

This Act, given Royal Assent on June 27, 1969 was at the close of 1969 applicable only to lands in the Yukon and Northwest Territories; however, it was expected that a bill to be placed before Parliament in early 1970 would make it applicable to all Canada lands outside the provinces.

The Act, which incorporates many features found to be effective in the provinces, provides for an Oil and Gas Committee under the direction of the Minister, consisting of five members to be appointed by the Governor in Council for a term of three years, one to be designated as Chairman for a term fixed by the Governor in Council.

Of the five members, two must have specialized, expert or technical knowledge of oil and gas, no more than three may be employees of the Public Service of Canada, and none may be employees of the Oil and Mineral Division of the Department which is charged with the management of the oil and mineral resources in Canada lands.

The Committee is empowered to hold enquiries, to hear appeals, and to make orders in connection therewith. It may make rules, consistent with the Act, regulating its practices and procedures, and the places and times of its sittings. For its purposes under the Act, it has all the powers, rights and privileges of a superior court of record.

The Act provides for a Chief Conservation Officer who shall normally be the Chief of the Oil and Mineral Division, and authorizes the Governor in Council to make regulations governing the exploration, drilling for, and production and conservation, processing and transportation of oil and gas, including the building of pipelines within, and the removal of oil and gas from the Territories.

OIL AND GAS REGULATIONS

It is the policy of the Department to provide a regulatory climate that will best encourage and provide for active exploration and orderly exploitation of oil and gas North of 60. This policy is expressed by the Regulations and Orders in effect for oil and gas administration which are made pursuant to the Territorial Lands Act, and Public Lands Grants Act.

Included in these on December 31, 1969 were:

- Canada Oil and Gas Lands Regulations
- Oil and Gas Land Order No. 1-1961
- Oil and Gas Land Order No. 2-1961
- Oil and Gas Land Order No. 1-1962
- Oil and Gas Land Order No. 2-1962
- Canada Oil and Gas Drilling and Production Regulations

The *Canada Oil and Gas Land Regulations* came into effect June 6, 1961, and have provided the basic structure for the disposal and management of the Canada Oil and Gas Lands. Exploratory rights are granted as permits to available grid areas or half grid areas upon application. The cost of a permit is a fee of \$250.00. A deposit of money, bonds, or promissory notes is required to ensure that a permittee does exploratory work to the value set out in the regulations, and this deposit is forfeited to the Crown to the extent that the value of the completed work approved fails to reach the value of the work required.

The holder of an Exploratory Permit has an exclusive option to acquire leases with a 21 year original term on up to 50% of the permit area. The leases may be no smaller than one section or larger than 6 sections by 3 sections. The lease rentals, 50c per acre in the first year, and \$1.00 per acre for the second and subsequent years, are reducible by one-half through the application of new expenditures or unallocated prior work expenditures throughout the life of the lease or until the commencement of production.

With the passage of Oil and Gas Land Order No. 1-1961, permittees were granted an exclusive 60 day option to acquire leases on the permit area surrendered to the Crown following the initial lease selection. The leases selected under this option carry additional royalties which vary with both location and rate of production. Figure No. 4 is a map showing the additional royalty rates by areas. Further details are outlined in the Schedules contained in the Canada Oil and Gas Land Regulations.

All oil and gas rights which are terminated become a part of the Crown Reserve. Three Oil and Gas Land Orders (Nos. 1-1961, 1-1962 and 2-1962) have been issued to provide the basic means of returning these rights to active exploration. Disposal of Crown Reserve land is made only at public sale through a call for tenders. The three basic forms of tender are: cash bonus, work bonus, and drilling commitments, and the rights offered may be individual leases, permits or blocks of leases or permits. Action taken in connection with the disposal of acreage under the Regulations and Land Orders are illustrated graphically by Figure No. 5. Individual leases and permits are offered for cash bonus; blocks of leases, for cash bonus



Photograph No. 1 — Panoramic view of the Mackenzie Delta

and an undertaking to drill to a specified depth; and blocks of permits for work bonus. The practice of offering blocks of permits for work bonus has been very favourably received by Industry and since the practice began in 1962, it has provided exploration expenditure commitments totalling approximately 35 million dollars.

Three amendments to the Regulations were passed during 1969, mostly designed to clarify and define elements of oil and gas land administration; however, the amendments did alter the qualifications for the holding of oil and gas permits and licences in respect to incorporation and established a new classification of marine permits.

EXPLORATION ACTIVITIES – 1969

Oil and gas expenditures in the Yukon Territory and Northwest Territories have exceeded 56 million dollars in 1969, this is an increase of about 20 million dollars over the previous year. Figure 6 illustrates total and final expenditures to 1967, and incomplete and estimated expenditures for 1968 and 1969 as recorded by the oil industry North of 60 together with a forecast for 1970. Most of the exploration was concentrated in three separate geographic areas, the southern portion of the territories, the Mackenzie Delta area and the Arctic Islands, specifically Melville Island.

Surface geological and photogeological surveys by the oil industry (measured in geological crew months) doubled over the previous year. Most of this can be attributed to the participation surveys initiated by V. Zay Smith and Associates on the mainland of the Yukon and Northwest Territories; by J.C. Sproule and Associates on the Arctic Islands, and by Pallister and Associates in carrying out their Arcticquest and Polarquest programs in the Arctic Archipelago.

A conglomerate of consulting firms in Calgary organized "Operation Geoquest" in 1968. The project involved assorted mapping programs in the Northwest Territories south of latitude 65°, Basic information was collected by surface geologic surveys, gravity and magnetometer surveys and structure test drilling. Land holders participating in this project could allocate expenditures to permits in the Northwest Territories and Yukon Territory.

A second and more extensive project "Operation Arcticquest" was organized by the same group. The geophysical programs was carried out along the Arctic Coastal Plain and in the offshore to about the 200 meter depth contour. Surface geologic work was concentrated in the Northern Yukon. Participants in "Operation Arcticquest" can allocate expenditures to permits approximately one hundred miles on either side of the Yukon and N.W.T. mainland coastline.

A third project, "Operation Polarquest" also organized by the same group of consultants included experts in other technical fields. Operation Polarquest will cover some 350,000 square miles surrounding the Arctic Islands. This effort, focused on the offshore areas, will complement the adjacent on-land exploration programs of Panarctic Oils, King Resources, Elf Oil and others on the Arctic Islands. Companies subscribed to 25 programs representing expenditures of about 3.5 million dollars for the first year of a four-year program. Programs approved included field geologic work; compilation of previous geologic, seismic and other work; a bathymetric program; environmental studies; an aeromagnetic program; a gravity program; and the first phase of feasibility studies on Arctic offshore drilling under various types of ice conditions. Seventeen contractors will be involved in Operation Polarquest.

Seismic activity in 1969 increased by over 100% over the previous year. A total of 160 seismic crew months were recorded, including marine offshore and marine Mackenzie River programs. The magnitude of activities in this type of exploration indicates an increased level of drilling in the future since it usually takes one to two seasons of seismic explorations to locate suitable drilling sites. The graph of exploration

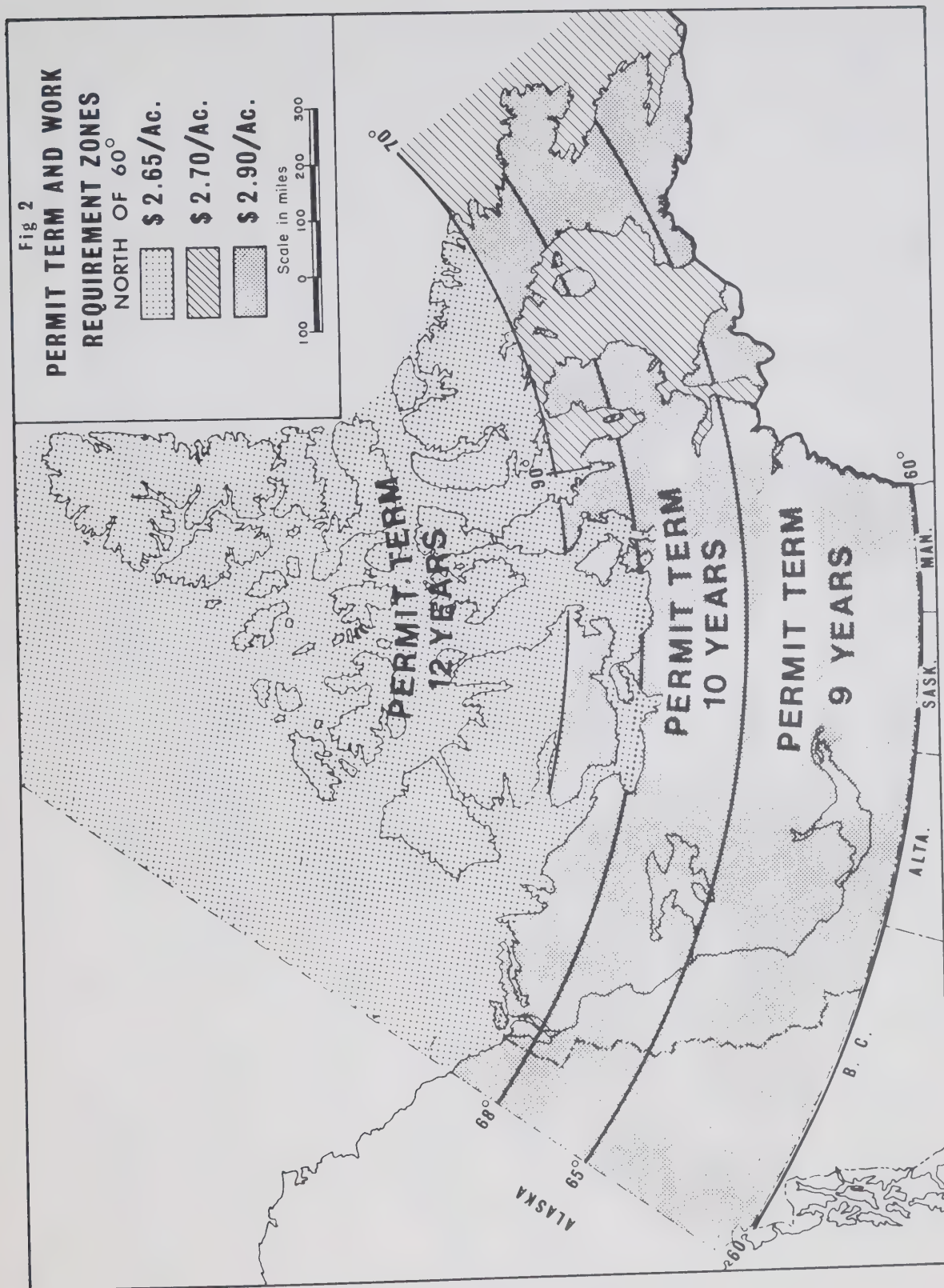


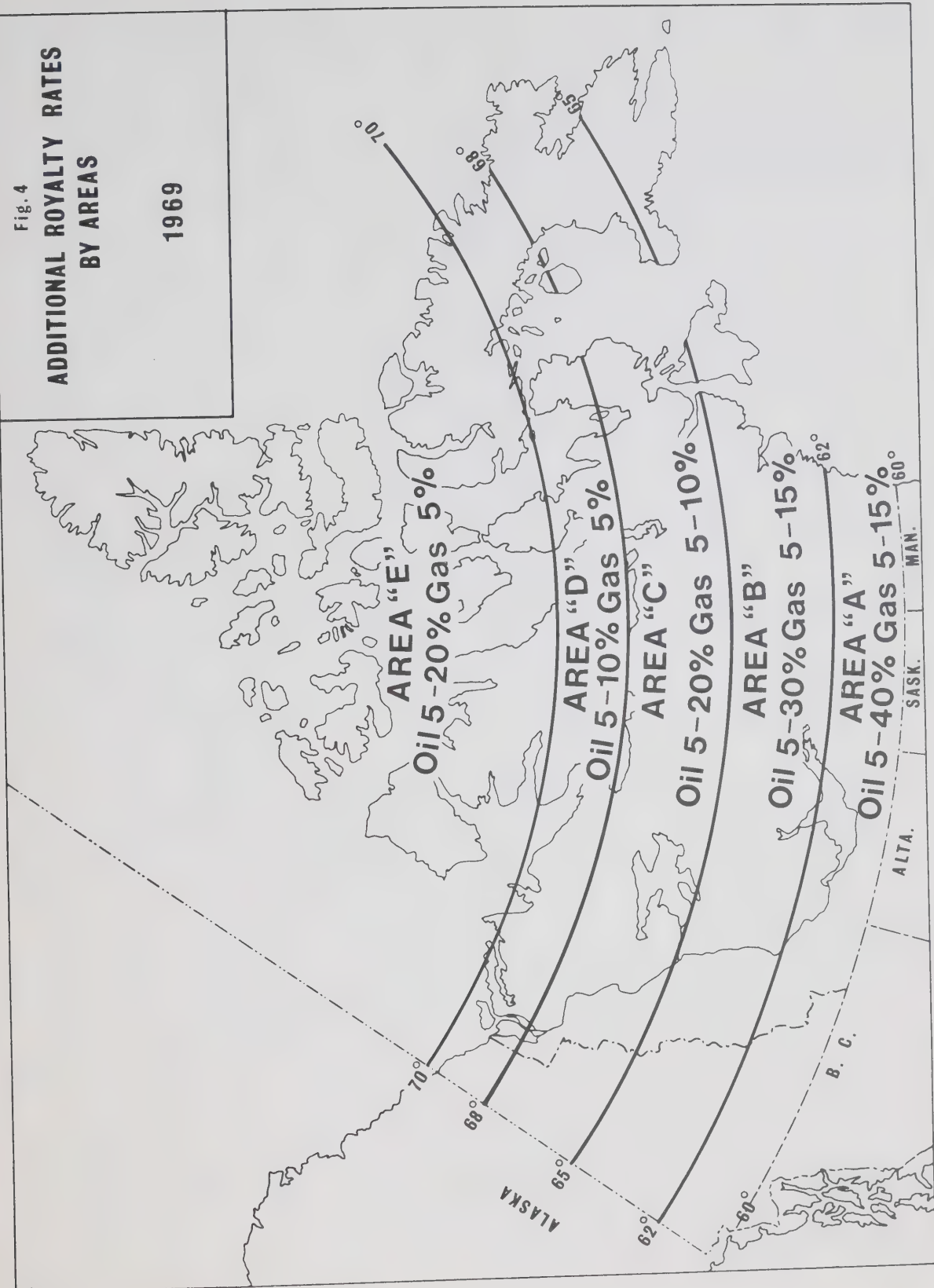
Fig. 3
YUKON TERRITORY - NORTHWEST TERRITORIES
PERMIT TERMS AND DEPOSIT REQUIREMENTS — PER ACRE

PERMITS LOCATED BETWEEN LATITUDES	RENEWAL TERMS													TOTAL WORK REQUIREMENTS
	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	
60° - 65°	<div>3 YEARS</div> <div>5¢15¢30¢50¢50¢50¢</div>													\$ 2.90
	<div>4 YEARS</div> <div>5¢15¢30¢40¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢20¢30¢50¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
65° - 68°	<div>4 YEARS</div> <div>5¢15¢30¢40¢50¢50¢50¢50¢</div>													\$ 2.90
	<div>6 YEARS</div> <div>5¢15¢20¢20¢30¢50¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
NORTH OF 70°	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													\$ 2.65
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
MARINE PERMITS LOCATED SOUTH OF 70° N WEST OF 90° W	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													\$ 2.65
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
SOUTH OF 70° N EAST OF 90° W	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													\$ 2.70
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢15¢20¢40¢50¢50¢50¢50¢</div>													
PERMITS LOCATED NORTH OF 70° ISSUED PRIOR TO 1968	<div>8 YEARS</div> <div>5¢15¢20¢20¢20¢20¢20¢20¢20¢20¢20¢20¢20¢</div>													\$ 2.65
	<div>6 YEARS</div> <div>5¢15¢20¢30¢50¢50¢50¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢30¢50¢50¢50¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢30¢50¢50¢50¢50¢50¢50¢50¢</div>													
MARINE PERMITS SOUTH OF 70° ISSUED PRIOR TO 1969	<div>6 YEARS</div> <div>5¢15¢20¢30¢50¢50¢50¢50¢50¢50¢50¢</div>													\$ 2.70
	<div>6 YEARS</div> <div>5¢15¢20¢30¢50¢50¢50¢50¢50¢50¢50¢</div>													
	<div>6 YEARS</div> <div>5¢15¢20¢30¢50¢50¢50¢50¢50¢50¢50¢</div>													
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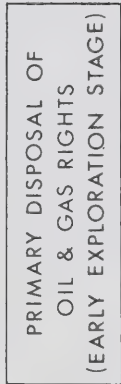
Fig. 4

**ADDITIONAL ROYALTY RATES
BY AREAS**

1969



FLOW DIAGRAM OF DISPOSAL OF OIL AND GAS RIGHTS



activity in Figure 7 indicates a constant increase in seismic activities since 1966 and a doubling of seismic operations in 1969. The expectation for 1970 is that activity will be maintained at the level achieved in 1969.

Oil companies undertook much of their seismic activity in the southern portion of both parts of the territories south of Fort Simpson and on the Peel Plateau. Imperial Oil Enterprises, however, continued to carry out large reflection seismic programs in the Delta and Tuktoyuktuk area. Marine seismic programs in 1969 were restricted to near shore areas by rafting ice conditions in the Beaufort Sea.

Drilling activity is illustrated in "Wells Completed and Abandoned in 1969", Map No. 3; "Wells Drilled", Figure No. 8; and "Footage Drilled", Figure No. 9.

A large gas discovery made in 1966 in the Pointed Mountain area of Fort Liard was followed up by a third successful gas well in 1969. Preliminary indications are that the reservoir has good porosity, permeability and productivity. A fourth well was commenced during the year but encountered severe subsurface and mechanical problems and had to be suspended. Current plans are now to skid the rig and drill a new well in the same target area.

Drilling activity has increased considerably in the past 3 years in the southern Northwest Territories. This, in part, can be attributed to fewer suitable exploration areas in the provinces; to the interest generated by the Alaska discoveries; and to the start of construction of year-round road systems in the territories which allow the price of exploration to be considerably reduced by the movement of equipment and supplies during 12 months of the year by conventional methods.

Two wells were drilled in the Delta Area by Imperial Oil and partners. Both achieved their stratigraphic objectives, but did not find commercial indications of oil and gas and were abandoned. The third current well, Imperial Atkinson H-25 recovered oil. Imperial Oil in a press release stated that medium gravity, sweet oil flowed to surface from the 5,700' level. Imperial now plans to fly a second rig into the area to begin offset drilling.

Oil and gas exploration in the Yukon in 1969 consisted of several restricted marine seismic programs off the Arctic Coast, and the drilling of an extension test in the Beaver River. Severe ice conditions along the Arctic Coast last year precluded carrying out extensive marine seismic surveys, thus only protected areas such as channels and ice-free bays were surveyed. Work is expected to continue on a larger scale in 1970.

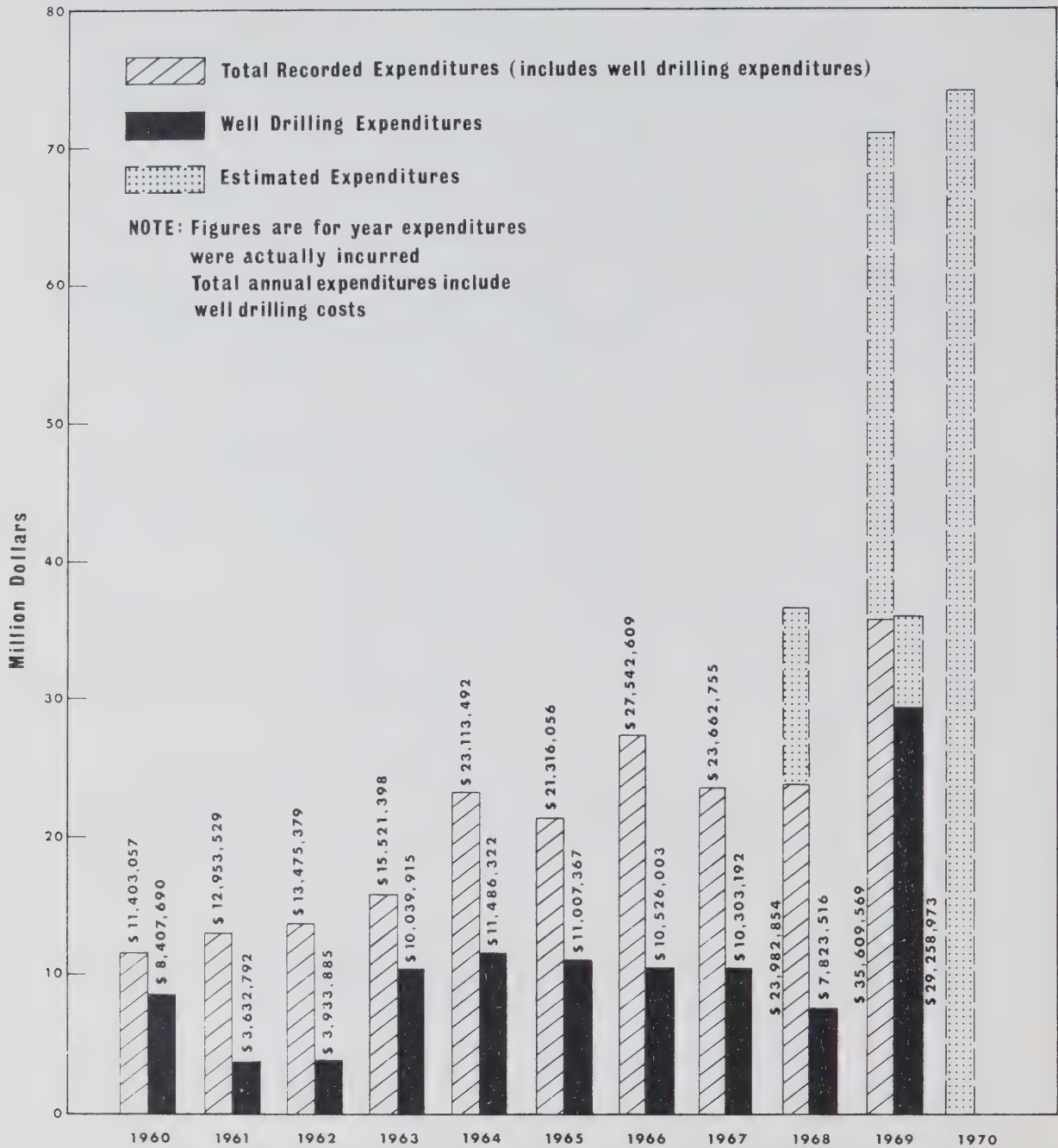
In the Liard Area, Pan American Petroleum Corporation drilled Beaver River Y.T. G-01 as a gas well and thereby extended the Beaver River gas field into Yukon Territory. The well is currently undergoing production testing and will be put into production as soon as pipeline facilities become available.

For a general review of Panarctic operations in 1969 and proposed plan for 1970, please refer to the following section.

The number of wells drilled and seismic crew months worked will increase or maintain the same level during 1970. If ice indications are favourable in the Beaufort Sea large marine seismic programs will then increase seismic exploration substantially. The continuation of Panarctic's drilling program; the proposed wildcat drilling in the Delta area; the Arctic Island drilling program by King Resources, Elf Oil, and Triad-BP will increase the number of wells drilled to at least 70 in 1970. Because drilling activities will increase substantially in the Arctic Islands and Delta areas total exploration expenditures may reach 75 million dollars in 1970.

Fig. 6

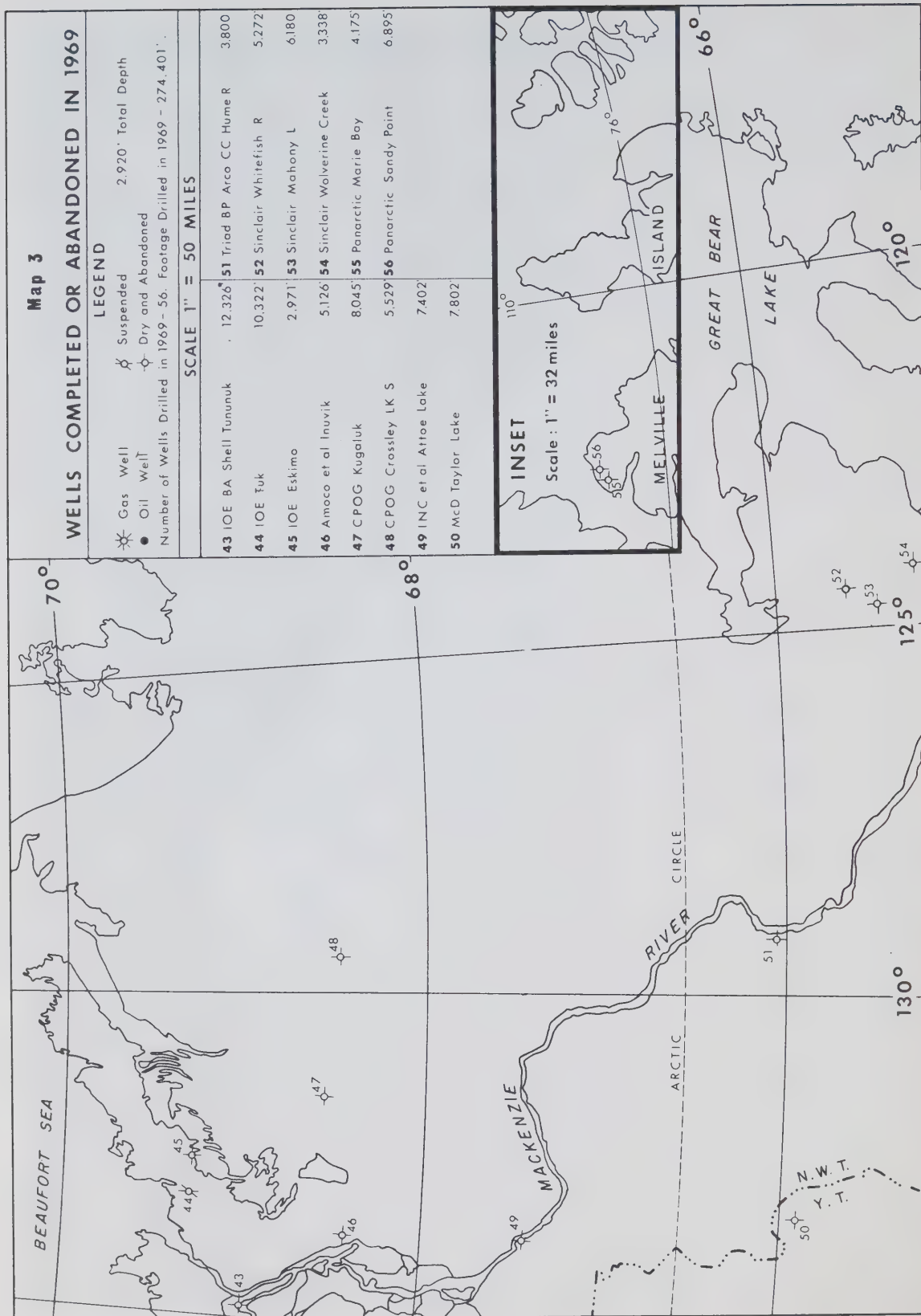
OIL & GAS EXPLORATION EXPENDITURES





Photograph No. 2 – Panarctic Drake Point L-67 Drilling on Melville Island

Photo Credits to Panarctic Oils Ltd.,



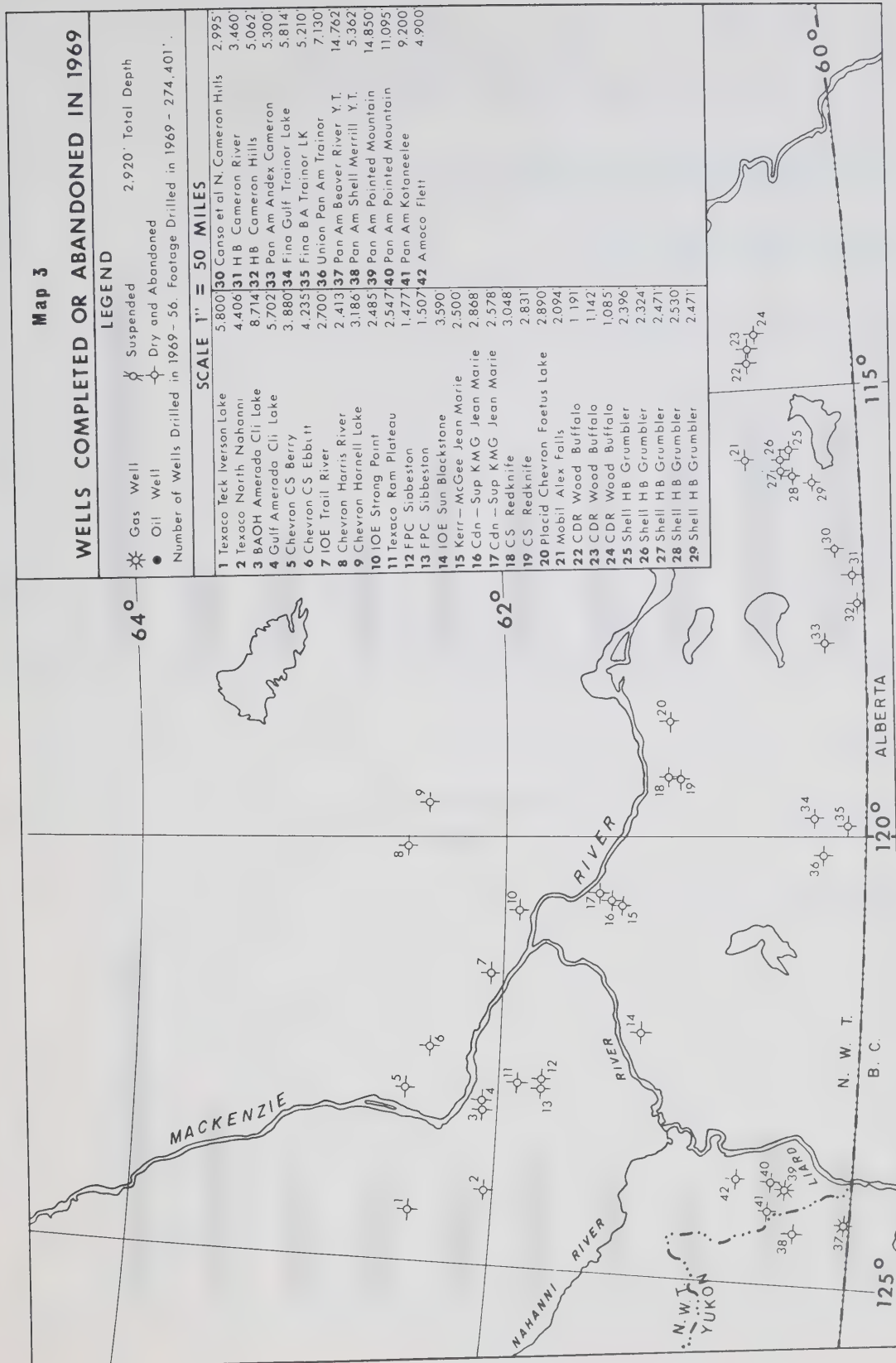


Fig. 7

EXPLORATION ACTIVITY

YUKON TERRITORY AND NORTHWEST TERRITORIES

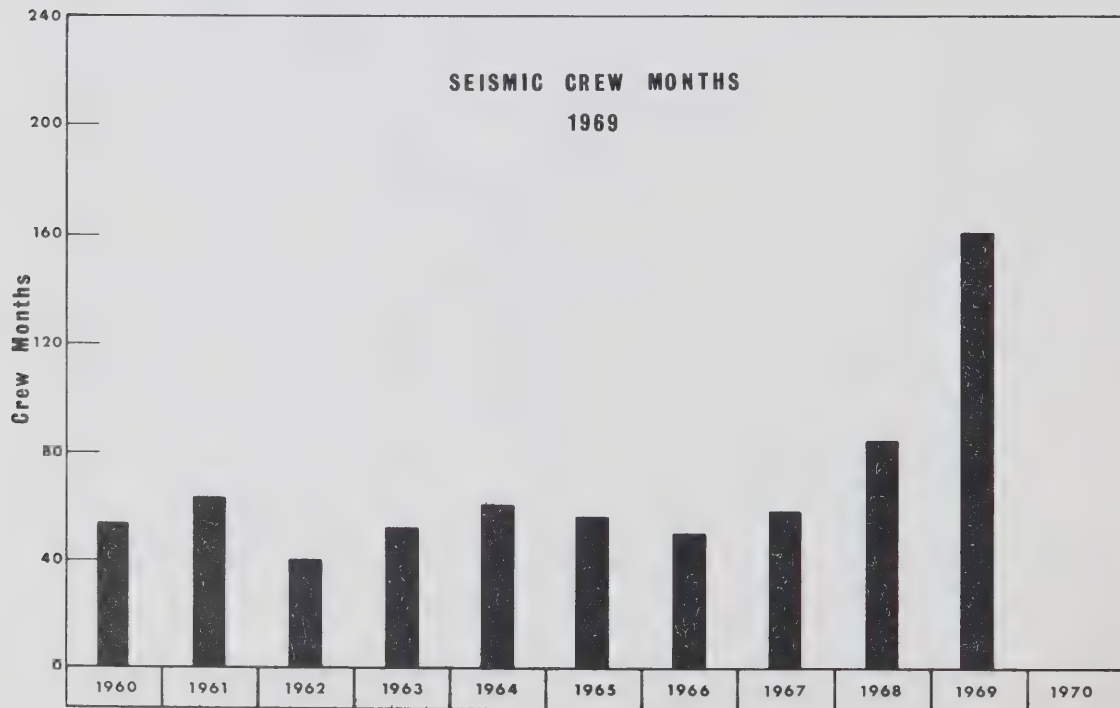
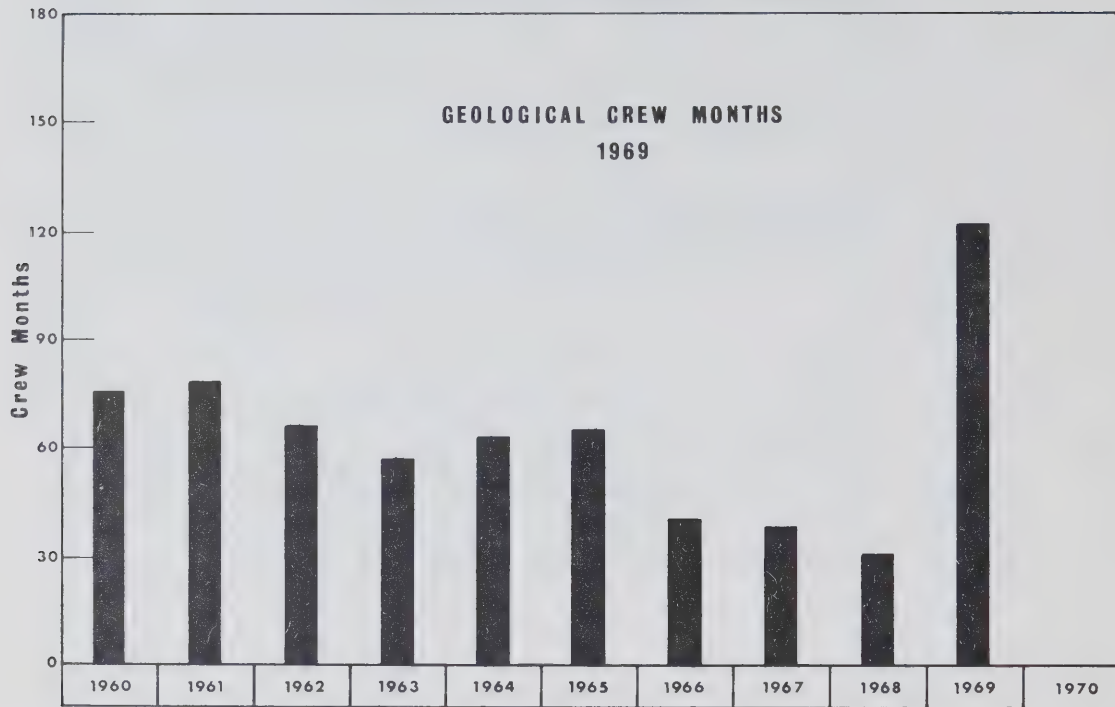


Fig. 8

WELLS DRILLED

YUKON TERRITORY - NORTHWEST TERRITORIES

Number of Wells Drilled to end 1969, 431

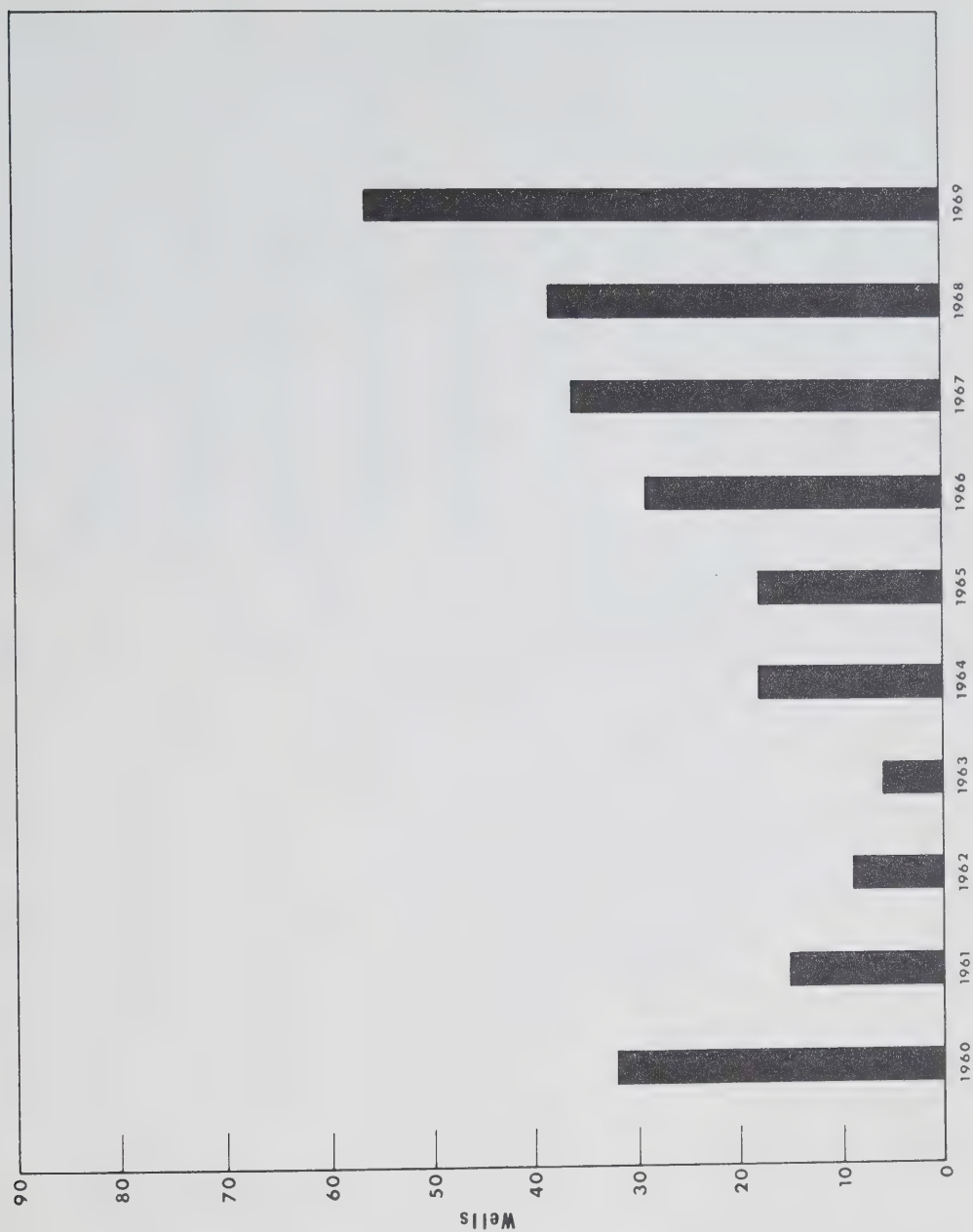
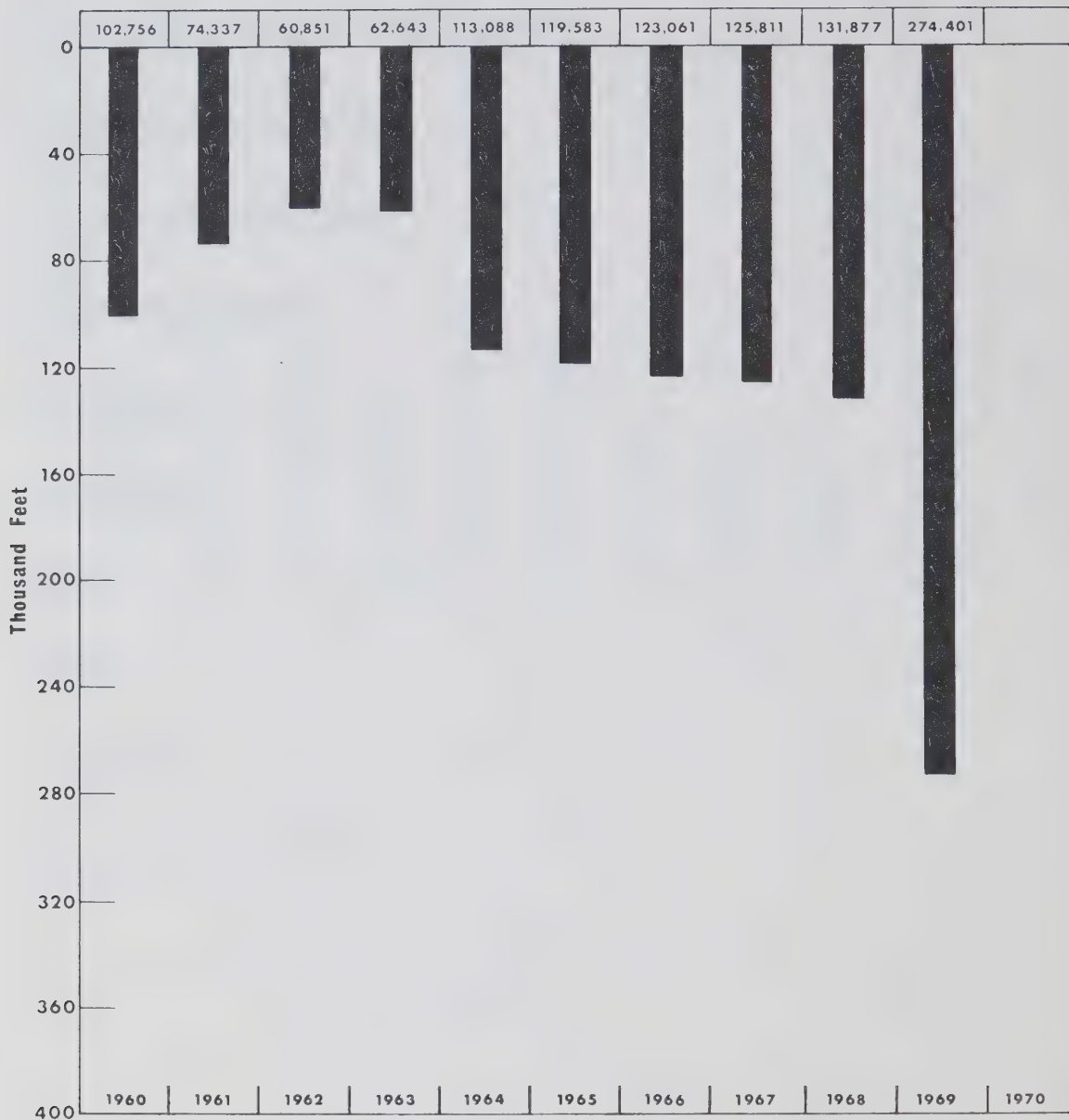
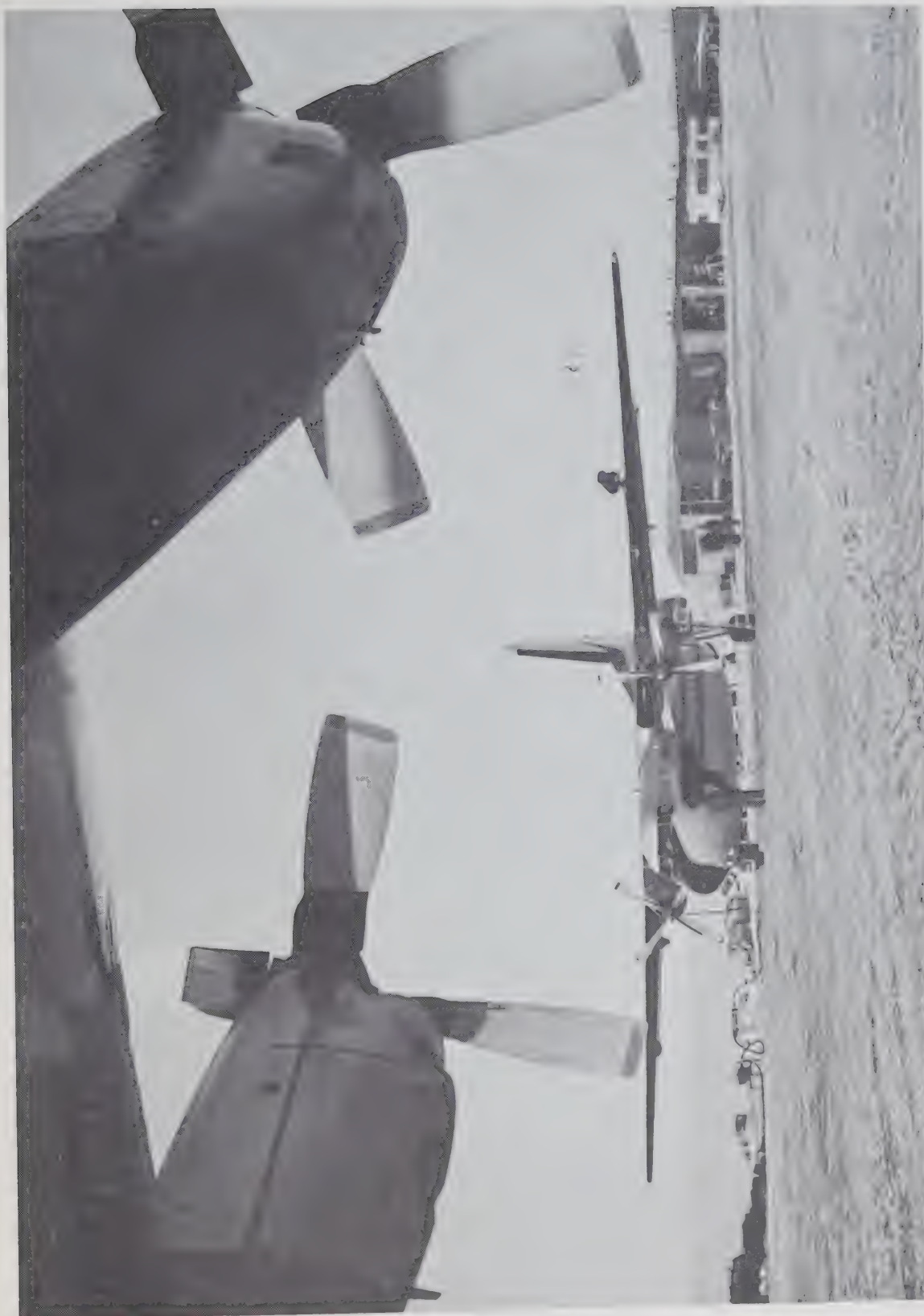


Fig. 9
FOOTAGE DRILLED
 YUKON TERRITORY AND NORTHWEST TERRITORIES





Photograph No. 3 — Panarctic Base Camp at Rea Point Melville Island

Photo Credits to Panarctic Oils Ltd.,

EXPLORATION – ITEMS OF INTEREST

Panarctic Oils Ltd.

During 1969, Panarctic showed a rapid growth in maturity as an operating entity, and has been able to secure commitments from industry for 9 wells on low priority holdings, thus securing for itself greater freedom to meet its high priority commitments on favourably located prospects.

The initial field exploration commenced March 1968 and continued in 1969. Surface geological surveys were continued on most of the central Arctic Islands and the 6 month geophysical program was successfully completed by tracked vehicles assisted by helicopters. Base camps with airstrips were set up at Winter Harbour, Marie Bay, Sherard Bay and at Rea Point, all on Melville Island. Stock-piles of fuel and drilling supplies were established at Resolute Bay, Sherard Bay and Rea Point. During the year a total of 788 miles of seismic surveys were carried out, including 708 miles of reflection shooting and 80 miles of refraction shooting. Work was carried out on the following Islands: Lougheed, Edmund Walker, Ellef Ringnes, Amund Ringnes, Cornwall, King Christian, Melville (Sabine Peninsula), Ellesmere (Fosheim Peninsula).

The drilling phase of the program commenced in April of 1969 when 2 drilling rigs were flown to Melville Island by Hercules aircraft. Panarctic Drake Point L-67 was spudded on April 9, 1969. After encountering severe gas blow-out problems, the well finally blew out of control at a depth of 8,595'. The well was blowing out of control at the end of the year, but a relief well was being drilled to control it from a location 1,200 feet away.

Panarctic Drake Point K-67A – spudded on September 28, 1969. This well tested gas in two zones believed to be those responsible for the blow-out in the L-67 well. It is intended to drill the K-67A well to its commitment depth and if oil is not found at lower levels, it is proposed to cut the 9 5/8" casing and whipstock below 2,409' to kill the L-67 well by pumping cement into the formation around the well bore in two stages; that is, at the levels of the two zones which were successfully drillstem tested in the second well.

Sandy Point L-46 – abandoned on the 2nd of August after having reached a depth of 6,895'.

Marie Bay D-2 – drilled to a final depth of 4,176' and abandoned on September 24, 1969.

Hoodoo Dome F-27 – drill site was selected on Ellef Ringnes Island. The contract for this well, awarded to Commonwealth – Hi Tower Arctic Joint Venture, calls for it to be drilled to an estimated depth of 14,500' using a rig which previously drilled the wildcat well on Bathurst Island.

Towson Point G-63 – Rig No. 2, after having drilled Marie Bay and Sandy Point, was transported to Rea Point to await acceptable flying conditions into the Towson Point location. The weather did not improve and winter darkness added to the problems of getting into this difficult location. Further efforts to move into Towson Point likely will be delayed until at least March 1970 when daylight starts to return.

Proposed operations for 1970 are further geological field surveys and a small seismic program in the northern Sverdrup Basin.

Drilling will be continued with the 3 rigs; a fourth rig may be moved to Fosheim on Ellesmere Island.

By the end of December 1969, Panarctic Oils Ltd. received the final payment of the initial \$9,022,500.00 government payment.



Photograph No. 4 — Unloading Drilling Supplies on Ellesmere Island from freight ship C.A. Crosbie
Photo Credits to Panarctic Oils Ltd.,

OIL AND GAS PRODUCTION AND CONSERVATION ACT

The need for an Oil and Gas Act to provide statutory authority for control of oil and gas production, the prevention of waste, and safety of operations in the North was first recognized by the Department early in 1960. Over the years, work on the proposed Act continued. This included research into the nature of the matter to be included, obtaining approval of the basic policies to be expressed in the Act, and the holding of relevant discussions with the Canadian Petroleum Association, the Chairman of the National Energy Board, and his senior staff, and the Deputy Minister of the Department of Mines and Technical Surveys, (now the Department of Energy, Mines and Resources) and his senior staff.

The Act, cited as the Oil and Gas Production and Conservation Act, was passed and assented to on the 27th June, 1969.

Pertinent Regulations pertaining to production, drilling, pollution, etc. were being readied at the end of the year.

NORMAN WELLS AGREEMENT

The Canadian Government entered into an agreement with Imperial Oil Ltd. on July 21, 1944. The agreement called for Imperial Oil Ltd. to develop the oil field at Norman Wells and to sell the oil products produced. The Government receives five per cent royalty on 2/3 of oil and gas production, which is Imperial's unit interest and all revenues from the sale of oil products on the remaining 1/3 of the field, less costs of production, refining, marketing and management fee. The initial term of 21 years of the original agreement ended on May 2, 1966. The agreement has been renewed for a further 21 years.

GAS PURCHASE AGREEMENT

The Westcoast Transmission Company and Pan American Petroleum Corporation have signed a contract for dedication of Pan American's partially developed gas reserves of the Beaver River Field, straddling the British Columbia – Yukon Territory boundary, and at Pointed Mountain in the southwest sector of the Northwest Territories, twenty miles north of the British Columbia – Yukon Territory boundary. The reserves proved and those developed in the Beaver River – Pointed Mountain area are needed by Westcoast Transmission to meet additional market requirements expected over a 25 year period.

The Beaver River gas pool in northeast British Columbia was discovered in 1958, and the Pointed Mountain gas pool in the southwest sector of the Northwest Territories in 1966. The Gas Purchase Agreement covers a purchase of natural gas at average and maximum daily delivery rates of 70 million and 100 million cu. ft. respectively by November 1969, to be increased to an average and maximum daily rate of 150 million and 205 million cu. ft. respectively on November 1, 1970. The contract covers also the construction of a 20 inch gas pipeline to extend north for 110 miles from the present terminus of the Westcoast Transmission Pipeline Company at Fort Nelson to the Beaver River gas pool.

If the development programs from Beaver River and Pointed Mountain are completed and a gas pipeline tied in, it is likely that Crown revenues from gas sales in the tri-corner area will be \$100,000 in 1972; \$750,000 to \$1.5 million by 1975 and possibly in excess of \$3 million in 1980.

PANARCTIC OILS LTD. FARMS OUT ACREAGE TO TWO LARGE INDEPENDENTS

Panarctic Oils Ltd. has recently concluded agreements with King Resources and with British Petroleum and Triad, for the drilling of 9 test wells in the Arctic Islands.

The King Resource Agreement, involving some 4,456,000 acres, requires the drilling of 9 wells ranging from 12,000 to 3,000 on three of the Islands in exchange for an undivided interest in the Panarctic



Photograph No. 5 — Producing Oil Well — Norman Wells Field

Photo Credit to Imperial Oil Ltd.

acreage. This farmout agreement is included in King's recently announced \$20,000,000 exploratory program.

The British Petroleum and Triad Agreement, covers 1,175,000 acres (originally acquired in part by Panarctic from British Petroleum and Triad) requires the drilling of two 12,000 test wells, and 400 miles of seismic surveys to earn an undivided interest in the acreage. As British Petroleum and Triad do not hold acreage in the Islands, the two companies will in effect be operating for Panarctic by meeting Panarctic's obligations under the original acquisition.

The current best estimate of the cost of the two agreements is 7.5 million and 3.2 million respectively for King Resources and B.P. The overall well commitments are for 5 wells of 10,000' or more, 2 wells of 6,000' and 2 wells 3,000' deep.

LAND-USE REGULATIONS

During 1969 the Department commenced preparation of Land-Use Regulations designed to minimize damage to the fragile northern land environment in the course of resource exploration and development.

The proposed Regulations will require exploration companies who wish to carry out a Land-Use operation North of 60 to apply for a permit and follow specific rules related to methods and timing of the operation.

The Department held a number of meetings with the petroleum and mining industries to ensure the Regulations would not be unduly restrictive, and with conservationists to ensure that adequate environmental protection measures were built in.

MACKENZIE VALLEY PIPELINES

One of the major markets for Prudhoe Bay oil is the north-central United States. Oil operators in Alaska and northern Canada realize that the most direct route from Prudhoe Bay in Alaska and the Mackenzie Delta area of Canada to the United States mid-west area is along the Mackenzie Valley, and that a pipeline built along this route would provide transportation for vast but as yet undiscovered oil reserves in northern Canada. Accordingly, a consortium of four oil exploration companies and two oil pipelines companies were formed to determine the technologic and economic feasibility of constructing a 48" diameter crude oil pipeline from the north slope of Alaska, up the Mackenzie Valley and on to Edmonton where it would connect with existing oil pipelines.

There were suggestions that a parallel gas pipeline would follow the same route but divide in the vicinity of Fort Simpson, one section proceeding to Fort Nelson to tie in with Westcoast Transmission Pipeline, the other segment to proceed to central Alberta to tie into existing pipeline facilities for gas transmission to central areas of the United States and Canada.

The major part of the research was contracted to Canadian Bechtel Limited. Since the announcement of the research project on July 14, 1969, other oil exploration companies making a total of eleven, and two gas pipeline transmission companies have joined the project.

RESERVES

A. Crude Oil Reserves

The geological basins comprising the Territories and Arctic Islands are only in the initial stages of exploration, so definitive crude oil reserves have little meaning at this time. However, the "Potential Reserves of Crude Oil Recoverable by Conventional Methods", compiled by the Canadian Petroleum Association, and released in April, 1969, are considered significant. The Canadian Petroleum

Association report states that the potential crude oil reserves for "all of Canada recoverable by conventional means is 120.8 billion barrels, of this total, 43.45 billion barrels is assigned to the Arctic Islands and Coastal Plain area; and (by interpolation) approximately 15 billion barrels are calculated for the rest of the Northwest Territories and the Yukon Territory. Thus, about 60 billion barrels of oil, or 50% of the total potential of Canada was computed to be located North of 60.

In a press release, the Association in an annual report outlining the reserves for Canada, report that the 1969 estimates of Proved reserves of liquid hydrocarbons in Canada "remaining at December 31, 1969, is 10.515 billion barrels; the proved reserves assigned to the Northwest Territories (Norman Wells field) is 46.105 million barrels."

B. Natural Gas Reserves

Natural gas reserves for the Arctic and Territories must also be considered largely in the potential state. The "Potential Reserves" of Canada as reported by the Canadian Petroleum Association is the most significant estimate available.

In their April 1969 report, the "Potential Raw Gas Reserves" for Canada are given as 724.8 trillion cubic feet. The potential reserves computed for the Arctic Islands are 260.7 trillion cubic feet; for the rest of the Northwest Territories and the Yukon Territory (by interpolation) are calculated at approximately 90 trillion cubic feet.

Reserves as reported recently are given by the Canadian Petroleum Association as 1.006 tcf Proved and 1.403 tcf Proved and Probable for the Pointed Mountain gas field. The report did not assign any gas reserves to the Yukon portion of the Beaver River gas field, or to 12 individual gas well discoveries in the Yukon and Northwest Territories.

REFINING OPERATIONS

A. Refinery Capacity

The only operating refinery located North of 60 is at Norman Wells and is operated by Imperial Oil Ltd. This refinery has a calendar day capacity of 1500 barrels and a stream day capacity of 1600 barrels. An extensive modernization program to increase capacity to over 2000 barrels per day was commenced in 1969.

REVENUES

One sale of oil and gas permit and lease areas was held in the latter part of January in 1969. Cash bonuses of \$3,717,991.27 and work commitments of \$23,941,715.68 were received on 1,497,886 acres and 3,016,440 acres respectively. Table No. 3 summarizes the results of the sale.

Revenues from Crown Reserve sales, lease and permit fees, royalties, rentals, etc. received during the fiscal year are shown in Figure No. 10 and Table No. 4. Figure No. 11 and Table No. 5 were compiled to illustrate revenues based on the calendar year 1969. Figure No. 11 shows the very strong growth in revenues other than cash bonuses that has been sustained since 1963.

PUBLICATIONS

A. Maps

Many maps dealing with the northern resource activities are published by the Division and are available from the Oil Conservation Engineer, Calgary, Alberta, or from the Chief, Oil and Mineral Division, Ottawa. The Oil and Mineral Division publishes a list of available maps which may be obtained from either of the above sources.

TABLE NO. 3

SUMMARY OF 1969

OIL AND GAS SALES

CASH BONUS PARCELS

Date	Acreage Offered At Sale	Acreage Sold	Percentage of Acreage Sold	Total Bids Received	Max. Bid per acre	Min. Bid per acre	Average Bid per acre
1969							
January 30, 1969	1,497,886	1,435,642	96%	3,484,221.49	12.60	0.19	2.43
WORK BONUS BLOCKS							
1969							
January 30, 1969	3,016,940	3,016,940	100%	23,941,715.68	24.66	0.13	7.94
DRILLING COMMITMENT LEASES							
1969							
January 30, 1969	30,290	30,290	100%	233,796.78	12.08	4.07	7.72

Fig.10

YUKON TERRITORY-NORTHWEST TERRITORIES

**GROSS REVENUE-OIL & GAS
FROM
CASH BONUS BIDS, FEES, FORFEITURES
ROYALTIES, RENTALS & SALE OF MAPS**

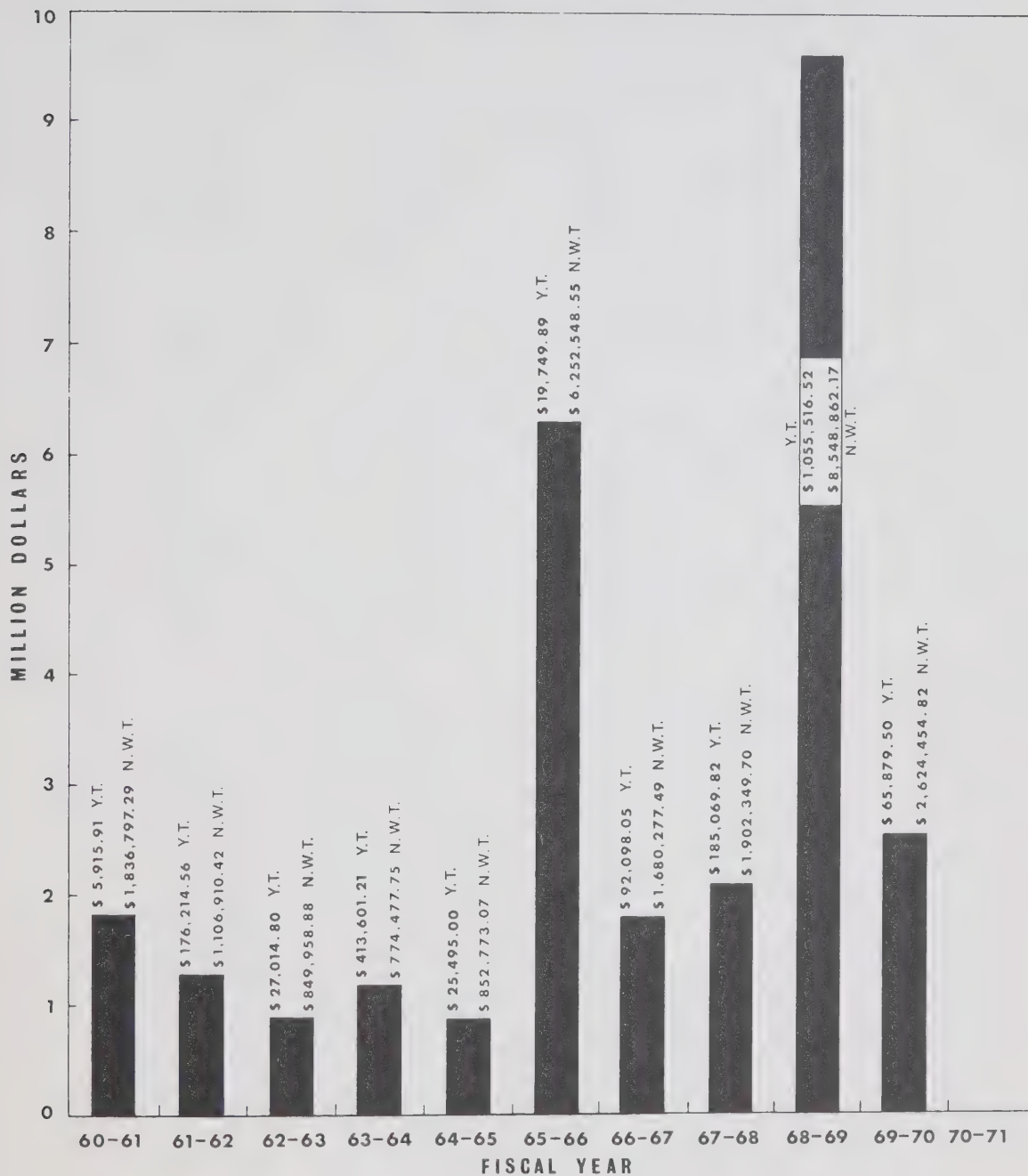


TABLE NO. 4

(By Fiscal Year)

NORTHWEST TERRITORIES

Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	Total
1963-64	1,950.00	183,250.00	7,550.00	40.00	157,519.99	69,882.00	18,288.12	334,395.06	1,023.00	773,898.17
1964-65	1,250.00	551,500.00	7,125.00	30.00	99,977.08	51,258.00	42,822.74	97,911.25	874.00	852,748.07
1965-66	1,425.00	344,000.00	7,850.00	1,050.00	350,130.08	178,878.00	69,952.16	5,298,589.01	674.30	6,252,548.55
1966-67	1,525.00	167,463.15	14,425.00	250.00	500,861.08	213,571.00	94,234.84	687,021.89	925.50	1,680,277.46
1967-68	2,148.18	112,000.00	7,465.00	1,830.00	815,186.24	106,229.00	36,336.07	825,045.35	1,109.86	1,902,349.70
1968-69	2,675.00	932,750.00	49,715.00	1,090.00	1,576,734.76	35,092.00	374,468.96	5,574,369.85	1,966.60	8,548,862.17
1969-70	3,800.00	392,700.00	59,230.00	2,240.00	2,124,690.05	19,630.00	19,852.44	—	2,312.33	2,624,454.82

YUKON TERRITORY

1963-64	—	23,500.00	—	30.00	6,610.00	—	—	383,461.21	—	413,601.21
1964-65	25.00	12,250.00	—	—	12,200.00	—	—	—	—	25,495.00
1965-66	—	—	—	—	13,220.00	—	6,529.89	—	—	19,749.89
1966-67	—	19,250.00	225.00	—	25,865.00	—	46,758.05	—	—	92,098.05
1967-68	—	9,750.00	—	70.00	11,888.25	—	139,834.86	23,526.71	—	185,069.82
1968-69	—	82,000.00	875.00	330.00	27,939.25	—	7,845.90	936,526.37	—	1,055,516.52
1969-70	—	10,000.00	—	—	55,879.50	—	—	—	—	65,879.50

GRAND TOTAL REVENUES

1963-64	1,187,499.38	—	1965-66	6,272,298.44	1967-68	2,007,419.52	1969-70	6,405,352.59
1964-65	878,243.07	—	1966-67	1,772,375.51	1968-69	9,604,378.69	—	—

Fig 11

YUKON TERRITORY - NORTHWEST TERRITORIES

GROSS REVENUE-OIL & GAS

FROM

CASH BONUS BIDS, FEES, FORFEITURES

ROYALTIES, RENTALS & SALE OF MAPS

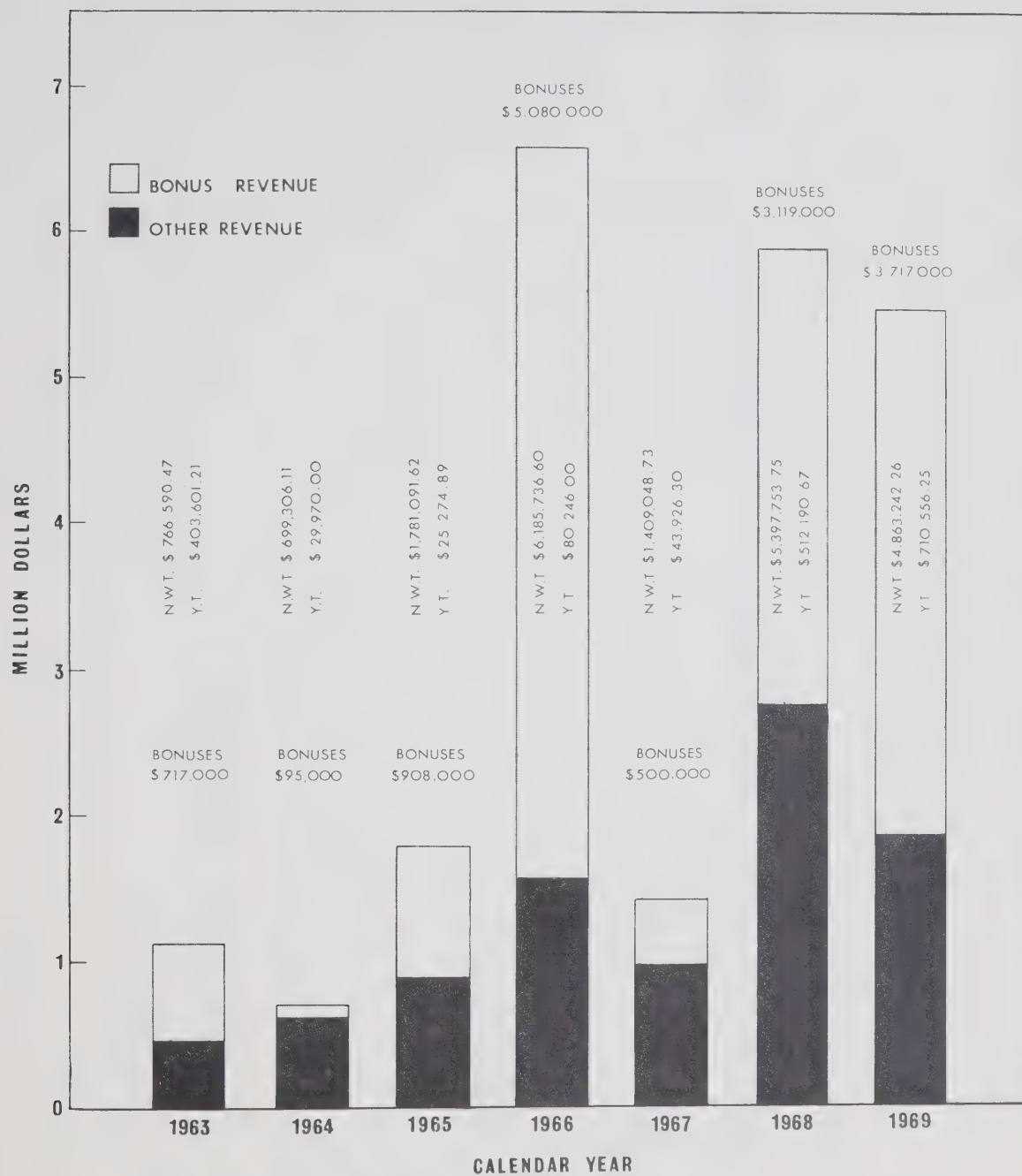


TABLE NO. 5
(By Calendar Year)

NORTHWEST TERRITORIES

Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	TOTAL
1963	1,600.00	155,500.00	8,200.00	140.00	157,396.56	69,882.00	39,343.52	334,395.06	633.33	766,590.47
1964	1,275.00	459,500.00	5,750.00	—	83,603.58	51,258.00	1,944.05	95,306.73	398.75	699,036.11
1965	1,425.00	323,000.00	7,275.00	890.00	280,449.08	178,178.00	78,826.31	909,353.25	995.00	1,780,391.64
1966	1,425.00	310,463.15	13,150.00	420.00	475,513.08	213,571.00	90,410.40	5,079,885.17	878.80	6,185,716.60
1967	2,175.05	96,250.00	9,475.00	760.00	682,500.74	106,229.00	36,106.20	484,623.02	929.72	1,419,048.73
1968	2,298.18	652,800.00	32,780.00	1,830.00	1,405,916.76	35,092.00	394,254.08	2,871,080.66	1,702.07	5,397,753.75
1969	1,975.00	320,450.00	45,140.00	1,290.00	1,404,600.82	19,630.00	19,852.44	3,043,711.52	1,521.18	4,858,170.96

YUKON TERRITORY

1963	—	13,500.00	—	30.00	6,610.00	—	—	383,461.21	—	403,601.21
1964	—	16,750.00	—	—	13,220.00	—	—	—	—	29,970.00
1965	25.00	5,500.00	—	—	13,220.00	—	6,529.89	—	—	25,274.89
1966	—	13,000.00	225.00	—	25,865.00	—	41,156.00	—	—	80,246.00
1967	—	9,750.00	—	70.00	11,888.25	—	5,602.05	16,616.00	—	43,926.30
1968	—	86,750.00	875.00	330.00	27,939.25	—	147,680.76	248,615.66	—	512,190.67
1969	—	8,500.00	—	—	30,749.50	—	—	671,306.75	—	710,556.25

GRAND TOTAL REVENUES

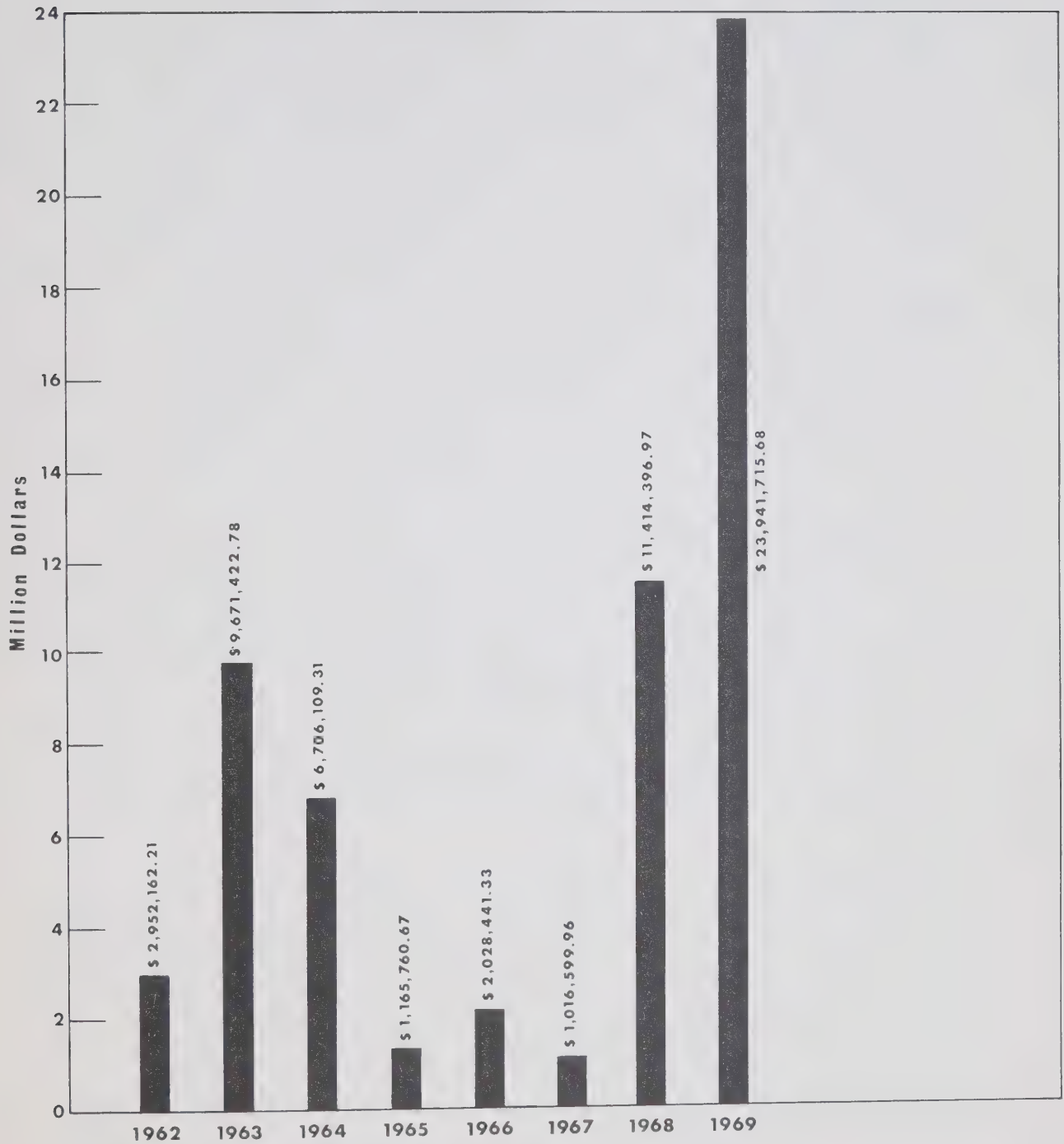
1963	—	1,170,191.68	1965	—	1,805,666.53	1967	—	1,462,975.03	1969	—	5,568,727.21
1964	—	729,006.11	1966	—	6,265,962.60	1968	—	5,909,944.42			

Fig. 12

VALUE OF WORK BONUS TENDERS YUKON AND NORTHWEST TERRITORIES

NOTE : Cumulative Value End of Dec.1969

\$58,896,608.91



B. Reports Available from the Queen's Printer and the Oil Conservation Engineer, Calgary, pre-payment is required

Schedule of Wells 1920 – 1960	– \$3.00
Schedule of Wells 1920 – 1961	– 4.00
Schedule of Wells 1920 – 1963	– 4.00
Schedule of Wells 1962 – 1964	– 2.00
Schedule of Wells 1965	– 3.00
Schedule of Wells 1966	– 3.00
Schedule of Wells 1967	– 2.50
Schedule of Wells 1968	– 2.50
Schedule of Wells 1969	– in press.
Oil and Gas Statistical Report No. 1 (1920–1960)	– 2.50
Oil and Gas Statistical Report No. 2 (1961–1965)	– in preparation
Economics of Oil and Gas Development in Northern Canada	– 3.25
“Technical Reports Available for Inspection 1969”. (Geological and Geophysical Reports released from confidential status are available for public inspection only in the office of the Oil Conservation Engineer of this Department in Calgary).	

OTHER SOURCES OF INFORMATION

Information on northern resources activities can be obtained from the Chief, Oil and Mineral Division, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa. All cores and samples from wells drilled on Canada lands are stored at the Institute of Petroleum and Sedimentary Geology, 3303 – 33rd St. N.W., Calgary, Alberta. Specialized and technical literature pertaining to Northern Canada can be purchased or perused at the following government agencies:

- (a) Northern Co-ordination and Research Centre and Library, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa 4, Ontario.
- (b) Department of Energy, Mines and Resources
 - 1. Geological Survey of Canada – Ottawa, Ontario, Vancouver, B.C.
 - Institute of Petroleum and Sedimentary Geology – Calgary, Alberta.
 - 2. Dominion Observatories Branch – Ottawa Ontario.
 - 3. Marine Sciences Branch Bedford Oceanographic Institute – Dartmouth, N.S.
 - 4. Surveys and Mapping Branch – Ottawa, Ontario
- (c) Defence Research Board Scientific Information Service

(d) Department of Transport

1. Marine Works Branch — Ottawa, Ontario
2. Marine Operations Branch — Ottawa, Ontario
3. Telecommunications and Electronics Branch — Edmonton, Alberta, Ottawa, Ontario
4. Civil Aviation Branch — Winnipeg, Manitoba
5. Meteorological Branch — Toronto, Ontario

(e) Arctic Institute of North America — Montreal, Quebec

(f) National Research Council — Ottawa, Ontario

(g) The following brochures may be available in some Public Libraries:

- i Guide to Northern Non-Renewable Resources
- ii Communication and Transportation Facilities Queen Elizabeth Group — Arctic Islands
- iii Resource Management Division — Responsibilities and Administration
- iv Oil and Gas Canada Lands — Volume No. 2
- v Oil and Gas Canada Lands — Edition No. 3
- vi Oil and Gas in the Yukon and Northwest Territories — Edition No. 4 — 1967
- vii Oil and Gas — North of 60 — 1968
- viii Prospectus — North of 60

INFORMATION AND PROCEDURES CONCERNING OPERATIONS ON CANADA LANDS

Certain federal agencies are concerned with exploration on Canada lands and must be notified prior to the commencement of any exploration activity. The operator or permittee — not the contractor is responsible for providing the requisite advance notice of planned programs to these agencies by writing directly to them.

For offshore programs the agencies that must be informed with respect to each and every program, in addition to the Oil and Mineral Division, are: the appropriate Maritime Commander in the Department of National Defence, the Aids to Navigation Division of the Department of Transport; and, in the case of seismic programs, the appropriate Regional Director of the Department of Fisheries. In the case of the Hudson Bay region, operators must also inform the National Research Council of proposed operations. Circumstances may be such that other agencies should be notified as well, and these are listed on the following pages, together with the names of persons who can be of assistance. For example, since operators are responsible for any damage they may cause to underwater commercial cables, it is recommended that they contact the Canadian Hydrographic Service for cable-lay data covering the area over which the work is to be performed. Similarly, Customs and Excise should be contacted by the importing company if vessels or equipment are to be brought in from abroad.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

1. Pursuant to Section 52, "Notices of Commencement of Exploratory Work" must be filed 15 days prior to commencement of proposed programs on the Mainland and Arctic Islands, and 45 days prior to commencement of exploratory work on offshore areas with the,

Oil Conservation Engineer,
Oil and Mineral Division,
112 - 11th Avenue S.E.,
Calgary, Alberta.

Phone: 403-264-0201

2. Information and assistance may be obtained from:

Chief,
Oil and Mineral Division,
Northern Economic Development Branch,
Department of Indian Affairs and Northern Development,
400 Laurier Avenue West,
Ottawa 4, Ontario.

Name: Dr. H.W. Woodward,
Phone: 992-5179

3. Advice on operational matters may be obtained from:

Operations Geologist,
Oil and Mineral Division,
Northern Economic Development Branch.

Name: S.A. Kanik
Phone: 992-2279

4. Information concerning wildlife such as the locations of migratory bird sanctuaries and National Wildlife Areas may be obtained from:

Director,
Canadian Wildlife Service,
Department of Indian Affairs and Northern Development,
400 Laurier Avenue West,
Ottawa, Ontario.

Attention: N.G. Perret
Phone: 992-5305

DEPARTMENT OF FISHERIES AND FORESTRY

Resource Development Service

Advance notice of 90 days is required before the start of a marine seismic survey involving the use of high explosives, in the event that qualified observers are needed. Nominal advance notice is required before

the start of seismic survey in which a source of accoustical energy other than high explosives is to be used. This Department must also be informed of any offshore drilling program prior to its commencement.

Written notices should be sent to the appropriate Regional Director of Fisheries with a copy to:

Director,
Resource Development Service,
Dept. of Fisheries and Forestry,
Sir Charles Tupper Building,
Ottawa 8, Ontario.

Name: B.W. Hamer
Phone: 997-4570

Information regarding the Department's requirement can also be obtained from:

Assistant Director,
Resource Development Service.

Name: E.W. BurrIDGE
Phone: 997-4526

The address of the Regional Director responsible for all fresh water lakes in the Northwest Territories is:

C. McEwan,
114 Gary Street,
Winnipeg 1, Manitoba.

Phone: 204-946-8101

For all fresh water in the Yukon Territory is:

W.R. Hourston,
1155 Robson Street,
Vancouver 5, B.C.

Phone: 604-666-1671

DEPARTMENT OF NATIONAL DEFENCE

Maritime Commanders

The appropriate Office of Maritime Command requires 45 days advance notice in writing of any exploration program proposed for the offshore. Relevant information will be supplied the operator on a need-to-know basis. Approval must be obtained from the Department before the commencement of work.

Operations in Baffin Bay, and Arctic waters east of longitude 105° West are handled by the office of:

Commander, Maritime Command,
Dept. of National Defence,
F.M.O., HMC Dockyard,
Halifax, Nova Scotia.

Operations in Arctic waters west of longitude 105° West are handled by the office of:

Maritime Commander (Pacific),
Dept. of National Defence,
F.M.O., HMC Dockyard,
Victoria, B.C.

DEPARTMENT OF TRANSPORT

Aids to Navigation Division

At least 60 days notice is required by this Division before the commencement of any offshore exploration program, in order that appropriate local Notices to Shipping and national Notices to Mariners may be issued. These Notices are subsequently copied into related foreign publications. The Division also indicates the requirement for any aids to navigation devices that may be necessary for the program.

Advance notice of 90 days is required in any case where a drilling program involves the territorial sea, in order for approval to be granted under the Navigable Waters Protection Act.

All communications on these matters should be directed to:

Chief, Aids to Navigation,
Marine Works Branch,
Department of Transport,
Ottawa, Ontario.

Phone: 992-2736

In addition, there are a number of Departmental officers who may be contacted in the field should the need arise. Their titles and addresses are given below:

District Marine Agent,
Department of Transport,
P.O. Box 310, Uppertown,
Quebec 4, Quebec.
(This office handles Hudson Bay)

District Manager,
Department of Transport,
P.O. Box 155,
Hay River, N.W.T.

Phone: 403-874-2331

Marine Operations Branch

This agency directs the operations of the Canadian Coast Guard which has major responsibilities in two areas of concern to offshore operations: support of shipping in ice-congested waters, and marine search and rescue.

If operations are being contemplated for areas where ice may be a problem and where ice-breaker or other support may be desired, there should be consultation with the Director of Marine Operations as long

in advance as possible. This is particularly important in the case of Arctic of Hudson Bay operations where the planning of ice-breaker disposition is usually done six months in advance of the season.

Further information and assistance may be obtained from:

Director,
Marine Operations Branch,
Dept. of Transport,
Ottawa, Ontario.

Name: A.H.G. Storrs
Phone: 992-4209

Marine Regulations Branch

The Branch includes the Steamship Inspection Division and the Nautical and Pilotage Division. The responsibilities of the former Division include inspection and certification of vessels under the Canada Shipping Act, oil pollution by ships, and safety of life at sea. The responsibilities of the latter Division include registration of shipping, marine accident investigation and enquiries, salvage, marine personnel, and navigation safety matters. This last includes the establishment of restricted navigation areas and the routing of ships.

Further information and assistance can be obtained from:

Director,
Marine Regulations Branch,
Dept. of Transport,
Ottawa, Ontario.

Name: R.R. Macgillivray
Phone: 992-8892

Meteorological Branch

Data regarding such matters as weather and ice conditions are compiled by the Branch and are available to operators and contractors on request. Information concerning these and relevant matters can be obtained through:

Meteorological Liaison Officer,
Dept. of Transport,
No. 3 Temporary Building,
Ottawa, Ontario.

Name: A.G. MacVicar
Phone: 992-4217

The position of Meteorological Liaison Officer is filled on a rotational basis and the name of the incumbent may change shortly for this reason.

Request for information on climatology, weather forecasting, meteorological instruments and research may be obtained by writing to:

Director,
Meteorological Branch,
Dept. of Transport,
315 Bloor Street West,
Toronto 181, Ontario.

Name: J.R.H. Noble
Phone: 416-966-6539

GOVERNMENT TELECOMMUNICATIONS POLICY AND ADMINISTRATION BUREAU

Radio Regulations Division

The powers, duties and functions of the Minister under the Radio Act have been transferred to the Minister of the Department of Communications. This action involves the Government Telecommunications Policy and Administration Bureau under which The Radio Telecommunications Regulations Branch is established.

Any company contemplating the use of radio communications in their exploration activities should contact:

Director,
Telecommunication Regulations Branch,
100 Metcalfe Street,
Ottawa 4, Ontario.

Name: W.J. Wilson
Phone: 992-0840 or 992-7643

Advice in determining communication requirements and the necessary application for licence may also be obtained from:

Chief,
Radio Authorization and Enforcement Division

Name: A.G.E. Argue
Phone: 992-3427

Oil companies in Western Canada may contact:

Radio Superintendent,
Telecommunications Regulations Branch,
Department of Communications,
Federal Building,
Edmonton, Alberta.

Name: L.E. Nelson
Phone: 403-424-0251
Extension: 334

DEPARTMENT OF ENERGY, MINES AND RESOURCES

Marine Sciences Branch

Every operator planning to undertake an offshore program is responsible for ascertaining the disposition of commercial cables within the area involved. For information of northern operators there are no cables in the Beaufort Sea. Information on commercial cable lays in other areas can be obtained from:

Canadian Hydrographic Service,
Marine Science Branch,
Dept. of Energy, Mines and Resources,
Ottawa 3, Ontario.

Attention: J. Bruce
Phone: 994-9487

NATIONAL RESEARCH COUNCIL

Space Research Facilities Branch

Operators planning offshore activities in the Hudson Bay region must inform the following agency of the National Research Council well in advance since rockets are fired on a year round basis from the Churchill Research Range:

Head,
Range Section,
Space Research Facilities Branch,
National Research Council,
Ottawa 7, Ontario.

Name: J.F. Aitken
Phone: 993-9225

Operators active in the Hudson Bay region are also required to co-ordinate their field activities with:

General Superintendent,
Churchill Research Range,
National Research Council,
Fort Churchill, Manitoba.

Name: J.H. Brandy
Phone: via The Pass, Fort Churchill, No. 123

Rockets are also launched from time to time from the facility at Resolute Bay, N.W.T. and operators with exploration work planned for this vicinity are urged to co-ordinate their activities with the National Research Council.

DEPARTMENT OF NATIONAL REVENUE

Customs and Excise

The Port Administration Division administers that portion of the Canada Shipping Act that relates to the coasting trade. In this connection, any company importing ships or specialized plant and equipment for

exploration work on Canada's seacoasts may obtain information, assistance and other contacts as may be necessary in Customs and Excise from:

Director,
Port Administration Division,
Customs and Excise,
Dept. of National Revenue,
Ottawa, Ontario.

Name: M.A. Gallup
Phone: 992-4952

DEPARTMENT OF MANPOWER AND IMMIGRATION

Canada Immigration Division

Enquiries should be directed to:

Department of Manpower and Immigration,
Canada Immigration Division,
Admission Section,
Ottawa, Ontario.

Attention: Mr. G.E. White
Phone: 992-3305

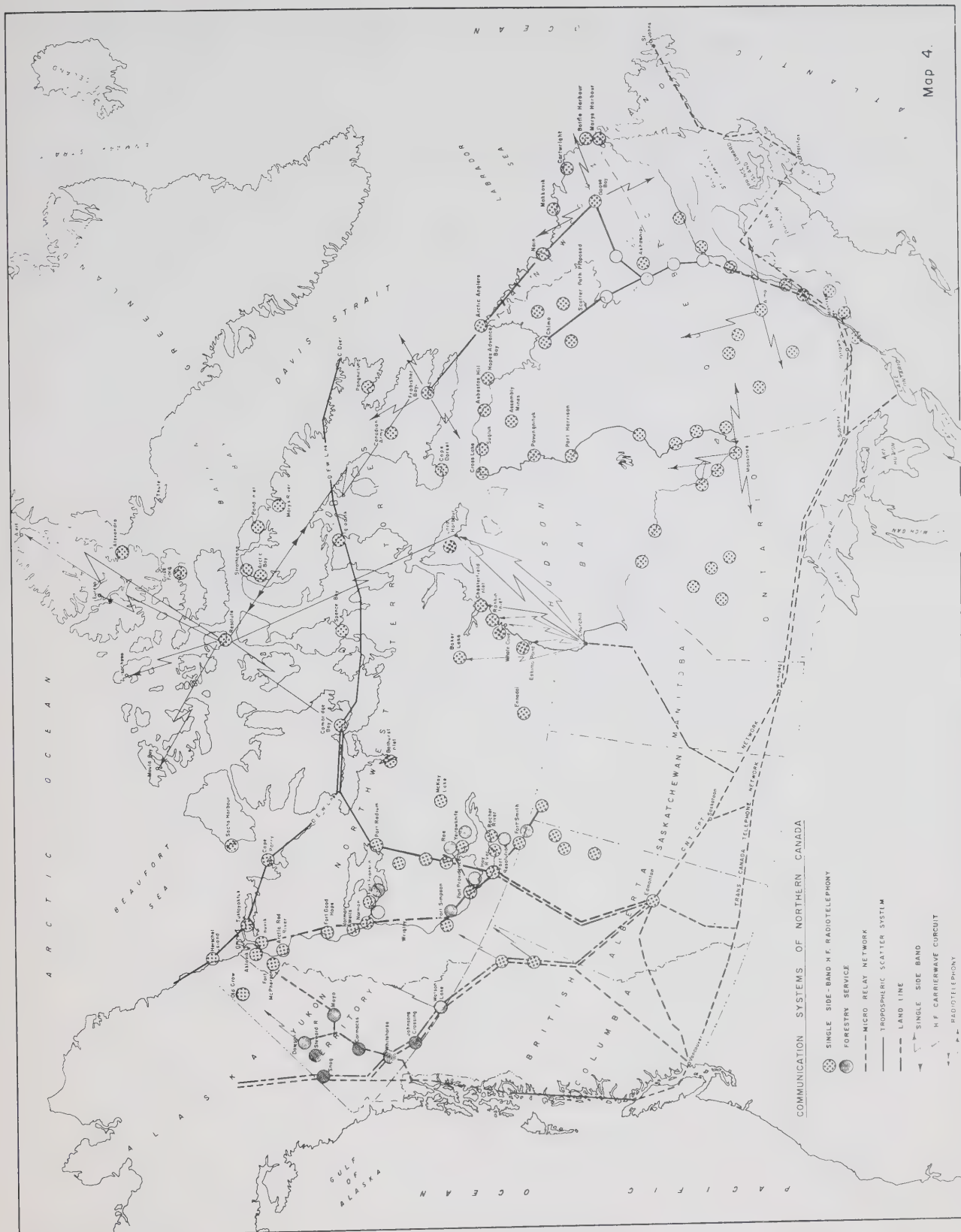
The Calgary and Edmonton offices of the Department of Manpower and Immigration can answer any queries regarding entry into the Northwest Territories. The Vancouver office can also respond to queries for entry into the Yukon Territory.

At Tuktoyaktuk, a local R.C.M.P. officer is also a representative of the Department of Manpower and Immigration and can clear entry into Canada via Tuk.

At Inuvik, the Customs Department has a Departmental Representative who can be contacted by telephone if prior arrangements are necessary. There is no representative at Aklavik; in the event that a seismic crew prefers to land at Aklavik, arrangements must be made with the Inuvik representative.

COMMUNICATIONS

The brochure, "Communications and Transportation Facilities, Queen Elizabeth Group, Arctic Islands", is being superseded by a comprehensive report entitled "Operational Guide for Oil and Gas Companies in the North". This publication is now in preparation and should be available by November 1, 1970. In addition to items such as communication and transportation, the report will cover all aspects of the exploration fields.









Map 4.

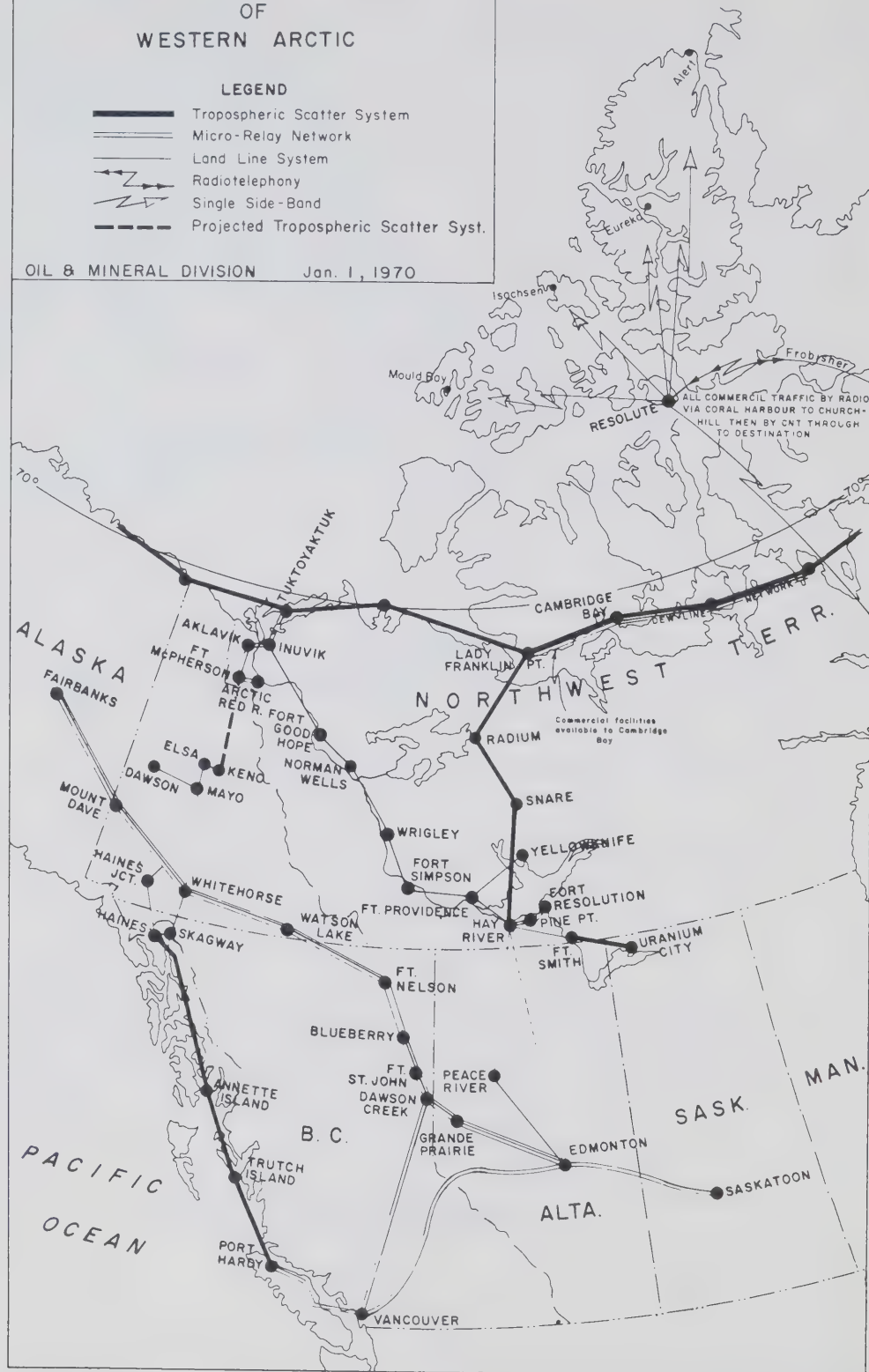
COMMUNICATION SYSTEMS OF WESTERN ARCTIC

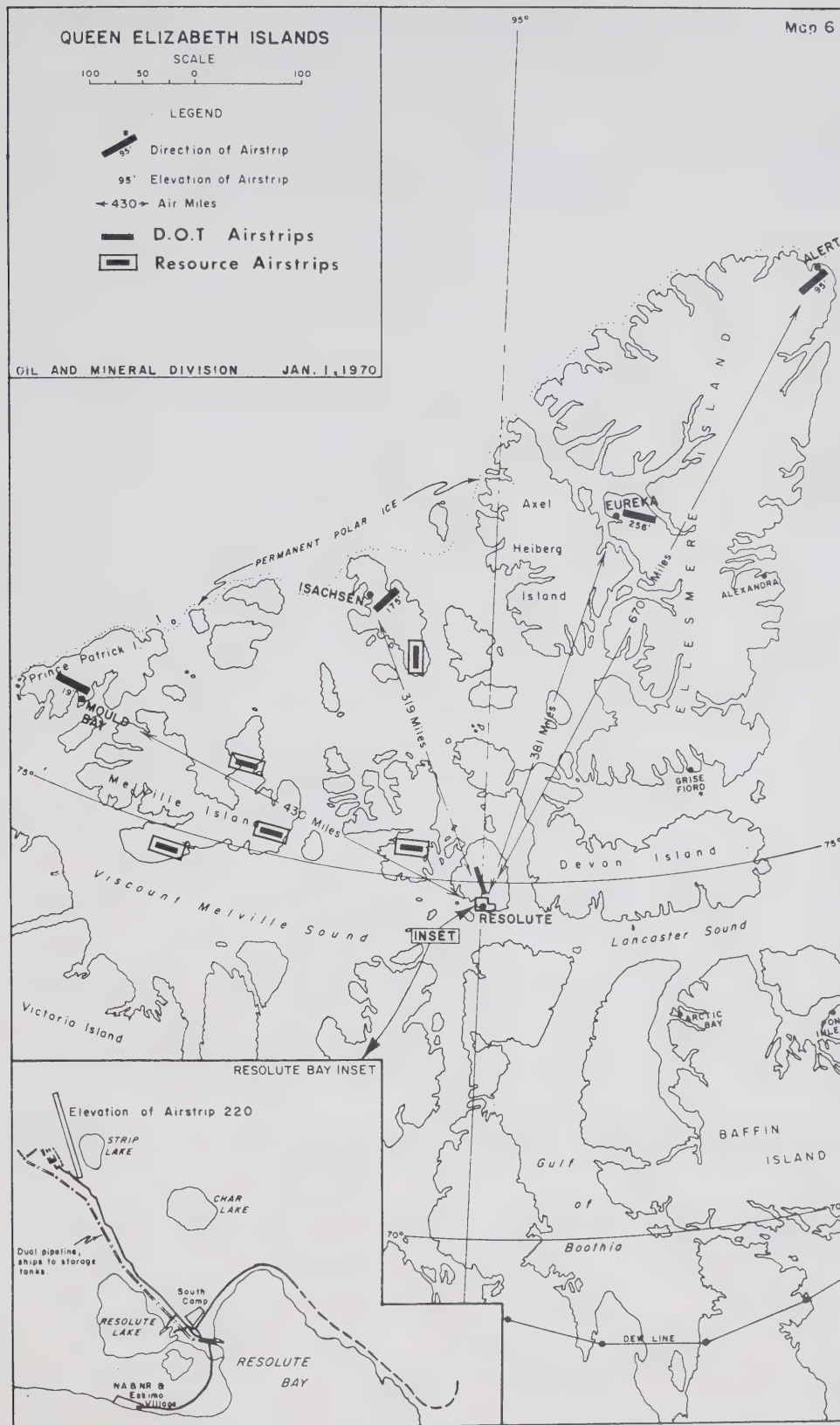
Map 5

LEGEND

-  Tropospheric Scatter System
-  Micro-Relay Network
-  Land Line System
-  Radiotelephony
-  Single Side-Band
-  Projected Tropospheric Scatter Syst.

OIL & MINERAL DIVISION Jan. 1, 1970





APPENDIX I

WELLS COMPLETED OR ABANDONED IN 1969

NORTHWEST TERRITORIES

<u>NAME OF WELL</u>	<u>SPUDDED</u>	<u>COMPLETED</u>	<u>STATUS</u>	<u>TOTAL DEPTH</u>
Amoco Flett N-19	11-8-69	17-11-69	D & A	4,900
Amoco et al Inuvik D-54	19-7-69	12-9-69	D & A	5,126
BAOH Amerada Cli Lake K-54	9-12-68	13-2-69	D & A	8,714
Canso et al N. Cameron Hills E-69	25-2-69	17-3-69	D & A	2,995
Cdn-Sup KMG Jean Marie N-73	10-2-69	25-2-69	D & A	2,868
Cdn-Sup KMG Jean Marie B-48	4-3-69	16-3-69	D & A	2,576
CDR Wood Buffalo C-74	7-4-69	7-5-69	D & A	1,191
CDR Wood Buffalo L-42	21-6-69	6-7-69	D & A	1,085
CDR Wood Buffalo C-03	15-5-69	15-6-69	D & A	1,142
Chevron CS Berry F-71	25-1-69	6-3-69	D & A	3,880
Chevron CS Ebbutt G-72	9-3-69	5-3-69	D & A	4,235
Chevron Harris River A-31	22-1-69	8-2-69	D & A	2,413
Chevron Hornell Lake G-24	14-2-69	3-3-69	D & A	3,187
CPOG Crossley LK S, K-60	28-8-68	9-3-69	D & A	5,529
CPOG Kugaluk N-02	2-4-69	19-12-69	D & A	8,045

<u>NAME OF WELL</u>	<u>SPUDDED</u>	<u>COMPLETED</u>	<u>STATUS</u>	<u>TOTAL DEPTH</u>
CS Redknife J-21	10-1-69	3-2-69	D & A	2,831
CS Redknife I-24	8-2-69	1-3-69	D & A	3,048
Fina BA Trainor LK P-55	9-1-69	18-2-69	D & A	5,210
Fina Gulf Trainor Lake G-07	24-2-69	20-12-69	D & A	5,814
FPC Sibbeston H-45	30-1-69	13-2-69	D & A	1,507
FPC Sibbeston E-45	14-2-69	26-2-69	D & A	1,477
Gulf Amerada Cli Lake G-15	23-2-69	21-3-69	D & A	5,702
HB Cameron River J-12	12-1-69	17-2-69	D & A	3,460
HB Cameron Hills F-51	9-3-69	2-4-69	D & A	5,062
INC et al Attoe Lake I-06	24-7-69	16-12-69	D & A	7,402
IOE Sun Blackstone E-72	11-12-69	30-12-69	D & A	3,590
IOE Eskimo J-07	10-5-69	31-5-69	D & A	2,971
IOE Strong Point G-24	28-1-69	16-2-69	D & A	2,485
IOE Trail River P-13	24-2-69	15-3-69	D & A	2,700
IOE Tuk F-18	29-12-68	27-4-69	Suspended	10,322
IOE BA Shell Tununuk K-10	13-8-68	28-6-69	D & A	12,326
Kerr-McGee Jean Marie C-73	22-3-69	29-3-69	D & A	2,500
Mobil Alex Falls B-07	28-1-69	23-2-69	D & A	2,094

<u>NAME OF WELL</u>	<u>SPUDDED</u>	<u>COMPLETED</u>	<u>STATUS</u>	<u>TOTAL DEPTH</u>
Pan Am Andex Cameron C-22	7-3-69	2-4-69	D & A	5,300
Pan Am Kotaneelee O-67	19-11-68	15-3-69	D & A	9,200
Pan Am Pointed Mountain G-62	9-7-68	23-6-69	Completed T.D. gas well P.B.D.	14,850 13,851
Pan Am Pointed Mountain O-46	29-3-69	14-12-69	Suspended	11,095
Panarctic Marie Bay D-02	13-8-69	24-9-69	D & A	4,175
Panarctic Sandy Point L-46	12-5-69	2-8-69	D & A	6,895
Placid Chevron Foetus Lake P-56	21-12-69	31-12-69	D & A	2,890
Shell H.B. Grumbler I-16	4-1-69	23-1-69	D & A	2,324
Shell H.B. Grumbler J-72	25-1-69	13-2-69	D & A	2,396
Shell H.B. Grumbler L-05	28-2-69	18-3-69	D & A	2,472
Shell H.B. Grumbler I-72	20-3-69	4-4-69	D & A	2,530
Shell H.B. Grumbler G-63	14-2-69	16-3-69	D & A	2,471
Sinclair Mahony Lake I-74	24-3-69	2-5-69	D & A	6,180
Sinclair Whitefish River K-76	30-1-69	18-3-69	D & A	5,272
Sinclair Wolverine Creek D-61	1-12-68	20-1-69	D & A	6,338
Texaco Teck Iverson Lake M-69	21-2-69	27-3-69	D & A	5,806
Texaco Ram Plateau N-44	20-12-68	12-1-69	D & A	2,547

<u>NAME OF WELL</u>	<u>SPUDDED</u>	<u>COMPLETED</u>	<u>STATUS</u>	<u>TOTAL DEPTH</u>
Texaco North Nahanni N-42	19-1-69	16-2-69	D & A	4,415
Triad BP Arco CC Hume R. A-53	4-7-69	26-7-69	D & A	3,800
Union Pan Am Trainor O-72	19-1-69	2-3-69	D & A	7,130
YUKON TERRITORY				
McD Taylor Lake Y.T. K-15	5-2-69	29-3-69	D & A	7,804
Pan Am Beaver River Y.T. G-01	6-12-68	20-8-69	Completed T.D. gas well P.B.D.	14,762 14,472
Pan Am Shell Merrill Y.T. L-60	24-1-69	6-3-69	D & A	5,362

NUMBER OF WELLS DRILLED IN 1969 – 56

TOTAL FOOTAGE DRILLED IN 1969 – 274,401

APPENDIX II

The Oil and Mineral Division is a member of the "Federal-Provincial Committee on Energy Statistics" and the "Mine Ministers Subcommittee on Oil and Gas Statistics" and together with the four western provinces and the D.B.S. has standardized all its oil and gas reporting forms. This standardization has removed duplication between government agencies and more important, industry can now process all oil and gas reporting forms from the western provinces and the Yukon and Northwest Territories on computer machines without change of programs.

FORM NO.	TITLE OF FORM
IAND*52-90-1**	Application for a Drilling Authority
IAND*52-90-2	Well Completion Data
IAND*52-90-3**	Application to Amend a Drilling Authority
IAND*52-90-4**	Application to Change a Well Name
IAND*52-90-5**	Application to Abandon a Well or Suspend Drilling
IAND*52-90-6**	Application to Alter Condition of a Well
IAND*52i-90-7	Work-over Report No.
IAND*52-90-8	Application to Commingle Production before Measurement
IAND*52-90-9	Data for Back Pressure Test on Natural Gas Wells — Monograph 7 Method
IAND*52-90-10	Data for Back Pressure Test on Natural Gas Wells — Vitter's Method
IAND*52-90-11	M.P.R. — Oil — Calculations
IAND*52-90-12	New Oil Well Report
IAND*52-90-13	New Gas Well Report
IAND*52-90-17	New Service Well Report
IAND*52-90-18	Monthly Water Flood Operations Report
IAND*52-90-20	Monthly Water Receipts and Disposal of Fluid Report
IAND*52-90-23	Geologic Surface Survey & Airphoto Analysis — Expenditures
IAND*52-90-24	Land Geophysical Operations — Expenditures
IAND*52-90-25	Marine Geophysical — Expenditures
IAND*52-90-26	Drilling & Structure Test Drilling Program — Expenditures
IAND*52-91	Notice of Commencement of Exploratory Work
IAND*52-92	Application for Authority to Drill Structure Test Hole
IAND*52-93	Report on Abandonment of Structure Test Holes
IAND*52-83	Grouping Notice
IAND*52-103**	Application for Oil and Gas Lease
IAND*52-183	Monthly Accident Summary

*To be completed by Operator.

**To be completed in triplicate; all other forms to be completed in duplicate.

All forms except IAND 52-83 and 52-103 are submitted to the Oil Conservation Engineer, 112-11th Avenue S.E., Calgary 21, Alberta.

Forms IAND 52-83, 52-90-23 to 52-90-26 and 52-103 are submitted to the Oil and Mineral Division, 400 Laurier Avenue West, Ottawa 4, Ontario.

The following forms have been issued pursuant to the "Canada Oil and Gas Land Regulations" and the "Canada Oil and Gas Drilling and Production Regulations". These forms are to be completed when applicable during the production stage of oil and gas wells, and refinery operations.

FORM NO.	TITLE OF FORM
IAN 52-116-1	Monthly Production Report
IAN 52-116-2	Monthly Disposition and Crown Royalty Statement
IAN 52-116-3	Monthly Gas Gathering Statement
DBS 6511-38*	Monthly Oil Pipeline Gathering Operations Statement
IAN 52-116-5	Monthly Crude Oil and Condensate Purchasers' Statement
IAN 52-116-6	Monthly Gas Plant Statement
DBS 6511-37*	Monthly Natural Gas Distributors Statement
IAN 52-116-8	Monthly Gas Processing Plant Products Statement
IAN 52-116-9	Monthly Liquefied Petroleum Gas Purchasers Statement
IAN 52-116-10	Monthly Refinery Operations Report
IAN 52-116-11	Monthly Gas Injection Operations Report
IAN 52-116-12	Statement of Nomination and Estimated Requirement for Crude Oil, Condensate and Pentanes Plus

NOTE: (a) All forms to be completed by the Operator.

(b) Forms 6511-37 and 6511-38 are completed by the Operator in triplicate. He forwards the first two copies to the Oil and Mineral Division and the third to the Oil Conservation Engineer, Department of Indian Affairs and Northern Development, Calgary, Alberta. The other forms listed above are completed in duplicate. The original is submitted to the Oil and Mineral Division in Ottawa and one copy to the Oil Conservation Engineer in Calgary.

APPENDIX III

Selected geological references applicable to geological provinces in northern Canada are listed below. References are Geological Survey of Canada publications unless otherwise noted.

NORTHWEST TERRITORIES

Memoir 273	The Lower Mackenzie River Area G.S. Hume
Memoir 322	Stratigraphy of Middle Devonian and Older Palaeozoic Rocks of the Great Slave Lake Region Northwest Territories. A.W. Norris
Bulletin 95	Carboniferous and Permian Rocks, Southwestern District of Mackenzie P. Harker
Bulletin 159	Study of pegmatite bodies and enclosing rocks, Yellowknife-Beaulieu region, District of Mackenzie R. Kretz
Bulletin 163	A Middle Cambrian Plagiura-Poliella faunule from southwest District of Mackenzie B.S. Norford
Bulletin 170	Middle Triassic (Anisian) ammonoids from northeastern British Columbia and Ellesmere Island F.H. McLearn
Bulletin 185	Barremian Textulariina, Foraminifera from Lower Cretaceous beds, Mount Geodenough section, Aklavik Range, District of Mackenzie T.P. Chamney
Paper 58-2	Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains J.A. Jeletzky
Paper 58-11	Great Slave and Trout River Map Areas R.J.W. Douglas
Paper 59-11	Horn River Map Area R.J.W. Douglas, et al
Paper 61-1	Summary Account of Carboniferous and Permian Formations Southwestern District of Mackenzie P. Harker

Paper 61-9	Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell Rivers J.A. Jeletzky
Paper 61-13	Camsell Bend and Root River Map Areas R.J.W. Douglas, et al
Paper 61-18	Geological Notes – Northern District of Keewatin W.W. Heywood
Paper 61-29	Upper Devonian Formations H.R. Belyea, et al
Paper 62-15	Middle Devonian and Older Paleozoic Formations of Southern District of Mackenzie H.R. Belyea, et al
Paper 62-33	Dahadinni and Wrigley Map Areas R.J.W. Douglas, et al
Paper 65-32	Geophysical Reconnaissance of Hudson Bay Peter Hood
Paper 66-50	Jurassic and Triassic Rocks of the Eastern Slope of Richardson Mountains Northwestern District of Mackenzie J.A. Jeletzky
Paper 67-8	Preliminary account of the Goulburn Group, Northwest Territories, Canada L.P. Tremblay
Paper 67-53	Reconnaissance Devonian stratigraphy of northern Yukon Territory and northwestern District of Mackenzie A.W. Norris
Paper 68-25	Subsurface geology, Lower Mackenzie River and Anderson River area, District of Mackenzie E.J. Tassonyi
Paper 68-47	Sekwi Formation, a new Lower Cambrian formation in the southern Mackenzie Mountains, District of Mackenzie R.C. Handfield
Paper 68-36	Preliminary notes on the Proterozoic Hurwitz Group, Tavani (55K) areas, District of Keewatin R.T. Bell

Paper 68-42	Stratigraphy of the Lower Proterozoic (Aphebian) Great Slave Supergroup, East Arm of Great Slave Lake, District of Mackenzie P.F. Hoffman
Paper 69-9	Stanton map-area, Northwest Territories (107D) C.J. Yorath and H.R. Balkwill
Paper 69-10	Simpson Lake map-area, Northwest Territories C.J. Yorath and H.R. Balkwill
Paper 70-12	Geology, Colville Lake map-area and part of Ermine map-area (96 NW and NE, part of 86 NW) Northwest Territories J.D. Aitken and D.G. Cook
GSC map 5-1969 (with notes)	Early Lake map-area, Northwest Territories J.D. Aitken, et al
GSC map 4-1969 (with notes)	Fort Good Hope map-area, Northwest Territories J.D. Aitken, et al
GSC Map 1230A, scale 1:63,360	Geology, Tumi Lake, District of Mackenzie J.C. McGlynn
GSC Map 1123A, scale 1:253,440, text	Geology, Reliance, District of Mackenzie C.H. Stockwell
GSC Map 1122A scale 1:253,440 text	Geology, Christie Bay, District of Mackenzie C.H. Stockwell and others
GSC Map 3-1969 (with notes)	Crossley Lakes map-area, District of Mackenzie
Inter Sym. On Dev. System A.S.P.G.	Upper Denovian ostracod faunas of Great Slave Lake and northeastern Alberta, Canada W.K. Braun
Inter Sym. on Dev. System A.S.P.G.	Ambocoeliid brachipods from the Middle Devonian rocks of northern Canada W.G.E. Caldwell
Inter Sym. on Dev. System A.S.P.G.	Devonian of northern Yukon Territory and adjacent District of Mackenzie A.W. Norris

EAGLE PLAIN AND NORTHERN YUKON

- Memoir 247 Physiography of the Canadian Cordillera with a Special Reference to the Area North of the Fifty-fifth Parallel
H.S. Bostock
- Paper 61-9 Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell Rivers
J.A. Jetetzky
- Paper 63-39 Reconnaissance of the Ordovician and Silurian Rocks of Northern Yukon Territory
B.S. Norford
- Paper 66-39 Descriptions of Devonian Sections in Northern Yukon and Northwestern District of Mackenzie
A.W. Norris
- Paper 67-53 Reconnaissance Devonian stratigraphy of Northern Yukon and Northwestern District of Mackenzie
A.W. Norris
- Paper 68-18 Stratigraphy and palynology of a Permian Section, Tatonduk River, Yukon Territory
E.W. Bamber and M.S. Barss
- Paper 68-27 Lower Cretaceous (Albian) of the Yukon
E.W. Mountjoy and T.P. Chamney
- Inter Sym. on
Dev. System
A.S.P.G. Upper Silurian and Lower Devonian biostratigraphy, Royal Creek, Yukon Territory, Canada
A.C. Lenz

SVERDRUP BASIN

- Memoir 320 Geology of the North Central Part of the Arctic Archipelago – (Operation Franklin)
Y.O. Fortier, et al
- Memoir 331 Geological Reconnaissance of Northeastern Ellesmere Island – District of Franklin
R.L. Christie
- Memoir 332 Western Queen Elizabeth Islands, Arctic Archipelago
E.T. Tozer & R. Thorsteinsson

Paper 60-7	Summary Account of Structural History of the Canadian Arctic Archipelago since Precambrian Time R. Thorsteinsson, et al
Paper 63-30	Mesozoic and Tertiary Stratigraphy, Western Ellesmere Island and Axel Heiberg Island E.T. Tozer
Paper 66-34	Lower Triassic Tar Sands of Northwestern Melville Island, Arctic Archipelago H.P. Trettin, et al
Paper 66-55	Ordovician Stratigraphic Section at Daly River, Northeast Ellesmere Island B.S. Norford
Paper 67-27	Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada. Proterozoic and Cambrian J.Wm. Kerr
Paper 67-27 pt II	Stratigraphy of Central and Eastern Ellesmere Island, Arctic pt. II. Ordovician J.Wm. Kerr
Paper 67-27 pt III	Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada pt II. Upper Ordovician, Silurian and Devonian J.Wm. Kerr
Paper 68-44	Analysis of aeromagnetic data over the Arctic Islands and Continental Shelf of Canada B.K. Bhattacharyya
Paper 68-16	Ellef Rignes Island, Canadian Arctic Archipelago D.F. Scott
Paper 68-17	Mesozoic and Tertiary stratigraphy at Lake Hazen, northern Ellesmere Island, District of Franklin A.A. Petryk
Paper 68-31	Upper Paleozoic and Mesozoic Stratigraphy in the Yelverton Pass Region, Ellesmere Island, District of Franklin W.W. Nassichuk and R.L. Christie
GSC Bull 183	Geology of Ordovician to Pennsylvanian rocks, M'Clintock Inlet, north coast of Ellesmere Island, Canadian Arctic Archipelago H.P. Trettin
GSC Map 10-1968	Southern Ellesmere Island, District of Franklin J.W. Kerr

Department of Energy, Mines and Resources, scale 1:1,000,000	Glacier map of northern Queen Elizabeth Islands (District of Franklin) W.E. Henock and A. Stanley
Bulletin of Canadian Petroleum Geology	March 1965 — Vol 13 No. 1 Lower Paleozoic Salt, Canadian Arctic Islands R.H. Workum
Bulletin of Canadian Petroleum Geology	Sept. 1964 — Vol 12 No. 3 Piercement Structures in the Arctic Islands Don B. Gould & George de Mille
Can. J. Earth Sci.	Geology of an outstanding aerial photograph at Cape Storm, Southern Ellesmere Island, Arctic Canada J.W. Kerr
Memoir 8, pp. 183-214	Piercement structures in Canadian Arctic Islands (In Diapirism and diapirs — a symposium: American Association of Petroleum Geologists D.B. Gould and G.DeMille
In Journal of Glaciology, Vol 8, No. 52, pp. 23-50	Glacial features of Tanquary Fiord and adjoining areas of northern Ellesmere Island, N.W.T. G. Hattersley-Smith
Oilweek, vol 20, No. 1 pp. 73-75	Bright glitter of Arctic black gold H. Heise
Inter Sym. on Dev. System A.S.P.G.	Devonian of the Franklinian miogeosyncline and adjacent Central Stable Region, Arctic Canada J.W. Kerr
Inter Sym. on Dev. System A.S.P.G.	Devonian of the Franklinian eugeosyncline H.P. Trettin

ARCTIC COASTAL PLAINS AND CONTINENTAL SHELF

Paper 63-22	Marine Geology, Eastern Part of Prince Gustaf Adolf Sea J.L. Marlowe, et al
Paper 68-27	Geology of the eastern part of the northern interior and Arctic Coastal Plains, Northwest Territories C.J. Yorath and others
Defense Research Board	Ice atlas of Arctic Canada C. Swithinbank

ARCTIC LOWLANDS

- Paper 63-44 Surficial Geology of Boothia Peninsula and Somerset, King William and Prince of Wales Islands
B.G. Craig
- Paper 64-47 Lower Palaeozoic Sediments of Northwestern Baffin Island
H.P. Trettin
- (In Arctic,
vol. 21, No. 2,
pp. 84-91 The Peel Sound Formation (Devonian) of Prince of Wales and adjacent islands
— a preliminary report
D.S. Broad and others
- In Canadian Journal
of Earth Science,
vol. 5, No. 4
Pt. 1 pp. 791-799 Sedimentary and paleontological features of the Tertiary-Cretaceous rocks of
Somerset Island, Arctic Canada
D.L. Dineley and B.R. Rust
- In Journal of
Paleontology, vol. 43,
No. 1 pp. 1-27 Lower Devonian conodont sequence, Royal Creek, Yukon Territory and
Devon Island, Canada, with a section on Devon Island stratigraphy, by A.R.
Ormiston
G. Klapper
- GSC map 6-1969
(with notes) Lac Belot map-area, Northwest Territories
- J. Paleont Helicoprion sp. and Ellasmobranch found in Permian rocks on Ellesmere
Island, Canadian Arctic
W.W. Nassichuk and Claude Spinosa
- In Maritime Sediments,
vol 4, No. 2 pp. 69-72 The submersible PISCES feasibility study in the Canadian Arctic
B.R. Pelletier
- Bull. Geol. Sec. Am.,
January 1969 A Paleozoic-Tertiary Fold Belt in northernmost Ellesmere Island aligned with
the Lomonosov Ridge
H.P. Trettin
- Bulletin vol. 80.
No. 1 pp. 143-148 A Paleozoic-Tertiary fold belt in northernmost Ellesmere Island aligned with
the Lomonosov Ridge
H.P. Trettin
- In Micropalaeontology
vol. 15 No. 1 pp. 35-60 Recent foraminifera in the Canadian Arctic
G. Vilks
- In Journal of
Paleontology, vol. 43,
No. 1 pp. 28-40 Permian Strophalosiidae (Brachiopoda) from the Canadian Arctic Archipelago
J.B. Waterhouse

FRANKLINIAN GEOSYNCLINE

- Memoir 294 Cornwallis and Little Cornwallis Islands — District of Franklin, Northwest Territories
R. Thorsteinsson
- Memoir 309 Permian Rocks and Faunas of Grinnell Peninsula — Arctic Archipelago
P. Harker, et al
- Memoir 316 Triassic Stratigraphy and Faunas, Queen Elizabeth Islands, Arctic Archipelago
E.T. Tozer
- Memoir 330 Banks, Victoria and Stefansson Islands, Arctic Archipelago
R. Thorsteinsson & E.T. Tozer
- Paper 67-64 Cornwallis Island and adjacent smaller islands, Canadian Arctic Archipelago
R. Thorsteinsson and J.W. Kerr
- Bulletin Canadian
Petroleum Geology
Vol. 15, No. 1 New Nomenclature of Ordovician Rock Units of the Eastern and Southern Queen Elizabeth Islands, Arctic Canada
Wm. Kerr
- Bulletin Canadian
Petroleum Geology
Vol. 13, No. 1 Middle Ordovician to Middle Silurian Carbonate Cycle, Brodeur Peninsula, Northwestern Baffin Island
H.P. Trettin

FOX E BASIN AND BAFFIN ISLAND

Foxe Basin

- Paper 62-35 Notes with Map 3 — 1958 and Map 4 — 1958 Fury and Hecla Strait; Foxe Basin North
R.G. Blackadar
- Geog. Bull 4 The Islands in Foxe Basin; Geog. Br. Department of Mines and Technical Surveys
PP. 1-29
- Paper 64-47 Lower Palaeozoic Sediments of Northwestern Baffin Island, District of Franklin
H.P. Trettin
- Maritime Sediments
vol. 4 No. 1, pp. 4-6 Sedimentological survey of Baffin Bay
J.J. Blee
- Map Glacier map of northern Baffin Island (Department of Energy, Mines and Resources scale 1:1,000,000). 1968

Map	Glacier map of southern Baffin Island . . . and northern Labrador Peninsula (Department of Energy, Mines and Resources, scale 1:1,000,000) 1968
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HUDSON BAY BASIN AND LOWLANDS

Paper 48-23	Flights over the North Magnetic Pole, the Mainland between the Arctic Coast, Great Slave Lake and Hudson Bay Y.O. Fortier
Paper 59-13	Aeromagnetic Surveys Across Hudson Bay from Churchill to Coral Harbour and Churchill to Great Whale River M.E. Bower
Paper 60-20	Belcher Islands G.D. Jackson
Paper 63-48	Sedimentology of Hudson Bay R.J. Leslie
Paper 67-24	Stratigraphic sections of Palaeozoic Rocks on Prince of Wales and Somerset Islands, District of Franklin, Northwest Territories R.L. Christie
Paper 67-60	Geology of the Hudson Bay Lowlands Operation Winisk B.V. Sanford, A.W. Norring, H.H. Bostock
Paper 69-8	Ordovician and Silurian biostratigraphy of the Sogpet-Aquitaine Kaskattama Province No. 1 well, northern Manitoba B.S. Norford
Bull��tin 164	Silurian cephalopods of James Bay Lowland, with a revision of the family Narthecceratidae R.H. Flower
In Canadian Journal of Earth Sciences vol 5, No. 5, pp. 1297-1303	An analysis of the crust-mantle boundary in Hudson Bay from gravity and seismic observations J.R. Weber and A.K. Goodacre

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northern economic
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and northern development
government of canada

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OIL AND GAS, NORTH OF 60

A report of Activities in 1970, of the
Oil and Gas Industry
In the Yukon Territory and Northwest Territories

1970

(Edition No. 7)

Compiled by
Oil and Gas Section
Oil and Mineral Division
Northern Economic Development Branch

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

Issued under the Authority of the
Honourable Jean Chrétien, P.C., M.P., B.A., LL.L
Minister of Indian Affairs and Northern Development
Ottawa, Canada

January 1, 1970

Information Canada
Ottawa, 1970

Cat. No. A71-6/1970

IAND Publication No.: QS-0831-010-EE-A-1

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INTRODUCTION

All aspects of oil and gas operations in the Yukon and Northwest Territories are administered by the Department of Indian Affairs and Northern Development, specifically by the Oil and Mineral Division. It is the intent of the Department to provide a regulatory climate that will best encourage and provide for the orderly exploration and exploitation of oil and gas thereby achieving benefits of a local nature to the specific areas involved and to the people of Canada in general through the attendant revenues accruing to the Crown.

The Minister and officers of the Department of Indian Affairs and Northern Development as of July 1, 1971, who are responsible for administering oil and gas resources in the Northwest Territories and Yukon Territory, and northern offshore areas, are:

Minister	— The Hon. Jean Chrétien, P.C., M.P.
Deputy Minister	— H.B. Robinson
Assistant Deputy Minister (Northern Development)	— A.D. Hunt
Acting Director Northern Economic Development Branch	— A.J. Reeve
Chief, Oil and Mineral Division	— Dr. H.W. Woodward
Administrator, Oil and Gas	— R.R. McLeod
Supervisor, Geological Operations Unit	— S.A. Kanik
Supervisor, Geological Evaluation Unit	—
Supervisor, Land Unit	— P. Sullivan
Chief Petroleum Engineer	— Dr. H.J. Berry
District Conservation Engineers	— A.C. Anderson for Queen Elizabeth Islands
	— M.D. Thomas for N.W. Sector
	— C.H. Olson for N.E. Sector
	— G.E. Blue for S.W. and S.E. Sectors at Yellowknife

OVERVIEW OF 1970 ACTIVITIES

The demand for oil and gas rights in Canada's North which followed the Prudhoe Bay discovery had virtually ended in 1970, largely because the greatest part of the potential areas had been acquired in the immediately preceding period by established oil companies and newcomers attracted by the prospects of large discoveries. The acreage remaining available was largely in areas of thin or severely disturbed sediments, or in deep water areas of relatively unknown potential. As a consequence total holdings of land increased by only three million acres during the year, although the minor part of it held in the form of leases increased by over 38% as the result of the maturation of older permits.

It was evident that the incentives provided by Canada Oil and Gas Land Regulations some ten years earlier were no longer required to attract exploration commitments in the North. It was equally evident that despite the commitments which were necessary to obtain the rights to explore, a complete evaluation would be impossible during the first sequence of exploration, and vast acreages would have to be returned to the Crown only partly explored.

New regulations were being prepared more suited to a second cycle of exploration by which the Canadian public would receive a greater reward. A preliminary draft of such terms was undertaken in consultations with the Department of Energy, Mines and Resources, which is responsible for the administration of the Regulations in Canada Lands off the east and west coast, in Hudson Bay and Hudson Strait.

To ensure that this action would not trigger a rush to convert older permits prematurely to lease in order to acquire the Crown reserves created thereby under advantageous existing terms by virtue of Land Order 1-1961, it was deemed necessary to revoke the Land Order for reconsideration together with the new Regulations.

Despite the strong negative response from industry the exploration effort continued to increase as had been expected, and brought two significant discoveries in widely separated areas. The first came early in the year at Atkinson Point on the mainland, 35 miles northeast of the village of Tuktoyaktuk. There on January 14, Imperial Oil Limited, a long time pioneer in the Canadian North, discovered oil at a depth of 5,700 feet in Cretaceous sandstone. Medium gravity, sweet crude flowed to the surface on a drillstem test, although further wells drilled on the peninsula were abandoned, the discovery is considered to be significant, and the discovery well was completed for production testing.

The second discovery occurred under less auspicious circumstances on King Christian Island, some 550 miles northeast of Point Atkinson. Here, on October 25, while pipe was being pulled from a depth of 2,010 feet, the Panarctic King Christian D-18 well blew out, caught fire and destroyed the rig. The well formed a crater, and fissures up to 500 feet in length opened up to release gas which took fire. The well flowed gas only, at a rate estimated at between 7 and 50 million cubic feet per day. A second rig was flown in and within a month spudded-in a relief well to begin relief operations which were to become a classic of its kind and to result in the successful control of the well two months later.

The wild well was the second major gas discovery in the Arctic Archipelago, and the second for Panarctic. The fact that it was, like the first, a blow-out caused the government some concern. As a consequence an official enquiry into the circumstances leading to the blow-out at the King Christian well was initiated under the authority of the Oil and Gas Production and Conservation Act. A senior petroleum engineer was appointed under the Act to conduct the enquiry. His report was being audited at year's end.

Particular concern has been felt about certain operations of the oil industry, largely as a result of recent events, which have focussed the world's attention on this industry.

At one stage in the development of the industry, a blow-out was an expected and hoped for result of the drilling of any prospective oil well. This was the famous "gusher" which was at one time the symbol of success and sudden wealth in the oil business. Today it is the symbol of ill-luck or bad management in the conduct of drilling and completion operations. The change has been brought about by good management, improvements in equipment and techniques, and conservation regulations aimed at preventing the dangers, waste, and destruction that often resulted before a "gusher" could be brought under control.

As a result of early lessons, techniques and equipment were developed by prudent and forward-looking elements of the oil industry and in many jurisdictions, the use of these techniques and the required equipment was made mandatory for all operators by the passage of so-called conservation acts and regulations designed to ensure that good practices were followed. Indeed, it was in connection with this industry that "conservation" first came to have real meaning and a wide practical application. Such regulations have reached

what is probably their most advanced form in Canada, possibly because public ownership of oil and gas resources in western Canada provided governments with a greater incentive to act. Whatever the reasons, Canada has been fortunate in having such legislation for many years, both at the provincial and federal level.

The Canada Oil and Gas Drilling and Production Regulations provide good example of such legislation. Made pursuant to the Territorial Lands Act in 1961 to replace earlier Regulations under that Act, they were also made pursuant to the Public Land Grants Act and consequently they apply to all Canada Lands outside of the provinces. They are administered by the Department of Indian Affairs and Northern Development, in the Yukon Territory, Northwest Territories, and Canada Lands under the seacoast waters of the Beaufort Sea, the Arctic Ocean, and the waters between and adjacent to the islands of the Arctic Archipelago; and by the Department of Energy, Mines and Resources in Canada Lands under the waters off the East and West Coasts, Hudson Bay and Hudson Strait.

These Regulations require all licencees to notify the District Conservation Engineers before commencing any drilling operations, and to obtain his approval of the program. Adequate casing and blow-out prevention equipment is mandatory, and broad discretion is given to the Conservation Engineers to ensure that proper practices are followed at all times and that only safe and proved equipment is used. To effect this, he may require the replacement or reconditioning of any tubing, casing or equipment, and may order operations to be discontinued until required action is taken. Daily reports must be made of all operations conducted at all wells prior to and including the day of suspension, completion or abandonment.

The Regulations made full provision for the prevention of waste, and require precautions to prevent contamination of the environment by drilling fluid, or oil or waste from tank or wells.

If a well becomes a menace to life or property, the Regulations empower the Minister to take over the management and at the expense of the licencee, to take such steps and employ such persons as are necessary to correct the situation.

In the absence of production these regulations were more than adequate, however, in anticipation of production on a large scale, the Oil and Gas Production and Conservation Act had been passed by Parliament and given Royal Assent on June 27, 1969. This Act broadens the statutory base for Regulations covering oil and gas operations in the Yukon and Northwest Territories, and provides for very broad additional powers for the Minister in respect of production and transportation of oil and gas under his jurisdiction. It provides also for an Oil and Gas Committee, under the direction of the Minister, to hold enquiries and hear appeals in connection with oil and gas matters. An amendment to extend this Act to all Canada Lands outside the provinces, including those under the jurisdiction of the Minister of Energy, Mines and Resources was given Royal Assent on June 11, 1970.

In addition to the special acts and Regulations covering the production and conservation of oil and gas, special regulations under the Territorial Lands Act for the preservation of the northern environment intended to protect Territorial Lands from operations not specifically covered by other legislation were in the course of preparation at year's end. They will call for entry permits to be obtained in advance for all operations on Territorial Lands which might be damaging to the environment, and will establish conditions to keep damage to a minimum. An amendment to the Territorial Lands Act was passed on June 26, 1970 to ensure full authority for the Regulations.

Interest continued in the problems of transportation of oil and gas from the North. Two pipeline research consortia were active during the year. Mackenzie Valley Pipeline Research Limited, a consortium of 16 oil and gas production and pipeline companies which had begun the building of research facilities at Inuvik in 1969 brought these into operation in February of 1970. A second pipeline research facility was prepared at San Sault, on the Mackenzie near Fort Hope by the Northwest Project Study Group a consortium of six production and gas pipeline companies.

One of the primary aims of the latter group is to investigate the transportation of gas through permafrost areas and other difficult northern terrain including muskeg. The handling of refrigerated natural gas is a feature of their experiment.

From the first realization of the magnitude of the Prudhoe Bay find, it has been considered likely that solution gas from the field would find its most likely way to market in the U.S.A. by a pipeline through Canada.

Reacting to the possibility of an early need for pipelines, the Department prepared guidelines for the construction and operation of northern pipelines and these were announced jointly by the Department of Indian Affairs and Northern Development, and the Department of Energy Mines and Resources on August 13, 1970. The guidelines emphasized the protection of the environment and set out the "corridor concept" by which initially only one gas trunk line and one oil trunk line would be permitted to be built in a "corridor" set up in consultation with Government and industry to provide either "common carrier" service, or service at a negotiated price for all oil or gas tendered to the respective lines with subsequent lines restricted as far as possible to the same route.

With the view widespread that economic transportation from the Arctic would be possible upon the discovery of large reserves, the hunt for oil and gas reserves picked up momentum.

The favourable result of Panarctic's search in the Arctic Archipelago encouraged the participants, in the venture and, when in response to the needs, further financing was necessary, all participants were eager to provide it. The Government of Canada as one of these participants, announced that the Government would invest an additional 13.5 million in the enterprise, further to its original 9 million, thus maintaining its interest in the same proportion as that of the private interests in this venture.

In conformity with the general optimism, and in spite of increasing requirements to protect the environment the level of all types of exploration increased markedly, placing Canada North of 60 second only to Alberta in exploratory effort in 1970. Details of this effort are portrayed in the text, tables, graphs and maps which form the body of this report.

POTENTIAL OF THE BASINS

Geologic Summaries

In Canada, north of Latitude 60° the areas outside the provinces contain 1,458,784 square miles, of this a total of 465,000 square miles are underlain by sedimentary rocks (Map No. 1) ranging from Cambrian to Tertiary that are considered to be potentially productive of oil and gas. The vast Territories sedimentary regions can be divided conveniently into several geological provinces each characterized by specific features of the contained sediments or structures in which they are involved. Hence a summary of the sedimentary geological provinces is given which focuses attention to their location and potential of these geological provinces, and a selected list of relevant geological references is

included. The reports listed for the Sverdrup Basin and the Franklinian Geosyncline are in large part also applicable to other basins in the Arctic Archipelago. All geologic references are listed in Appendix V.

Interior Plains

The Interior Plains are also commonly referred to as the Western Canada Sedimentary Basin. In this context the Liard Plateau and Mackenzie Plains are included in this geological province. The sediments range from Lower Paleozoic to Cretaceous and thicken westward into the Cordilleran Geosyncline.

Porous sandstones and carbonates are present in many formations within the sedimentary column. Gas discoveries have been made at Rabbit Lake, Netla, Celibeta, Island River, Trainor Lake, Beaver River and Pointed Mountain. The Norman Wells oil field is located on the Mackenzie Plains west of the Franklin Mountains.

Arctic Lowlands

The Arctic Lowlands consist of several basins lying between the Franklinian Geosyncline and the Canadian Shield on the mainland. It is not known whether they are structural or depositional in origin. Sediments consist of carbonates and clastics, and range from Cambrian to Mesozoic and Tertiary. Thickness of sediments probably does not exceed 10,000 feet and the principal rocks are carbonates of Ordovician and Silurian age.

Franklinian Geosyncline

The Franklinian Geosyncline encompasses sedimentary basins in the Arctic Archipelago that include the Ellesmere fold belt, Cornwallis and Parry Island fold belts. Most of the structures are generally characterized by long, wide, symmetrical folds. Sediments range from Cambrian to Permian and thicknesses may range up to 20,000 feet.

Much of the early exploration in the Arctic was concentrated in this geologic province, in 1962–64 three wells were drilled and abandoned. They are:

- No. 1 Dome et al Winter Harbour
- Lobitos et al Cornwallis Resolute Bay L-41
- Dom. Explorer et al Bathurst Caledonian R. J-34

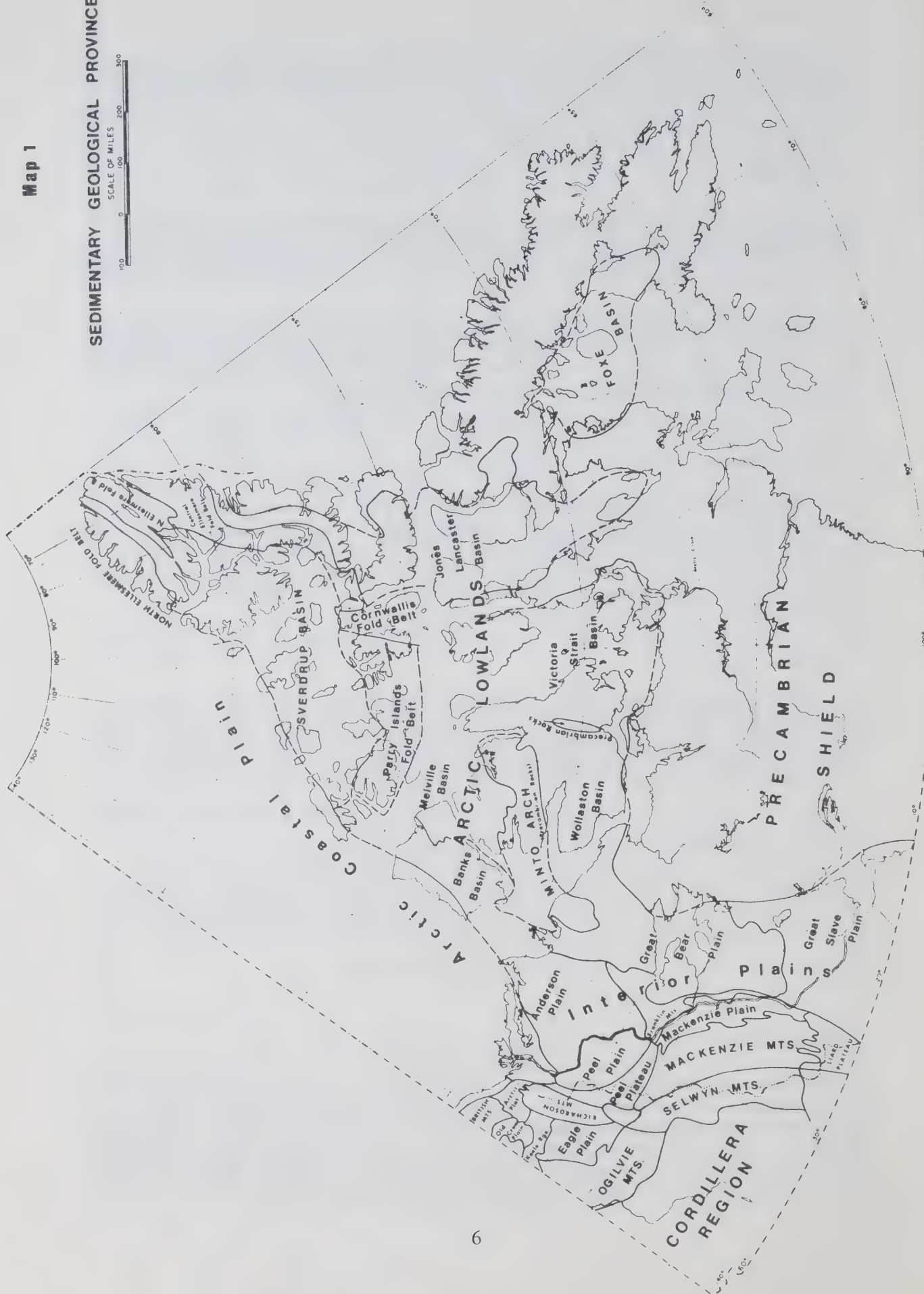
In 1970, Panartic Oils Ltd. drilled only one well, Panartic Towson Point F-63 in this basin.

Sverdrup Basin

The Sverdrup Basin may contain one of the thickest sequences of sediments in North America. Composite thicknesses are in the order of 60,000 feet and range in age from late Paleozoic to early Tertiary. The principal rocks are Pennsylvanian, Permian and Triassic. Reservoir rocks consist of thick sections of limestone reefs and sandstone. The Bjorne formation of Triassic age contains oil impregnated sands on Melville Island, significant evidence of hydrocarbons in the sediments of the Arctic Islands.

Map 1

SEDIMENTARY GEOLOGICAL PROVINCES





Photograph No. 1 — Examining rock outcrops in Northern Canada

The major structures are large symmetrical folds that include Tertiary beds. In certain areas of the Basin, piercement domes, evaporite diapirs, sills and dykes are mapped. These secondary structures may from trapping mechanisms for hydrocarbon accumulation.

During 1969 and 1970 Panarctic Oils Ltd. drilled a total of seven wells in the Sverdrup Basin. One of the wells, Panarctic Drake Point L-67 is a completed gas well. A second gas discovery at Panarctic King Christian D-18A was made early in 1971.

Foxe Basin

The Foxe Basin is generally less than 300 feet in elevation and underlain by flat lying Paleozoic rocks. Recent work indicates that the outcrops are Ordovician and bear distinct similarity to rocks on Cornwallis Island. The detailed stratigraphy is unknown, therefore the thickness can only be surmised to be 3,000 to 4,000 feet.

Hudson Bay Basin and Lowlands

Sedimentary rocks in the Hudson Bay area, which include the large Islands, are of Ordovician, Silurian, Devonian, and Mesozoic age. The Paleozoics are correlated with rocks in Manitoba while many of the fossils can be compared to fauna of the same age in Ontario. Magnetometer and seismic surveys in the Bay indicate that between 5,000 and 10,000 feet of sediments may be present.

Structurally the sediments dip basinward while the carbonate rocks on Southampton and Coates Islands appear to be essentially flat lying.

Arctic Coastal Plains and Continental Shelf

The Arctic Coastal Plains geographically are located along the northwest fringe of the Arctic Archipelago and geologically include the Continental Shelf. The area is overlain by Tertiary and Pleistocene sediments and dip oceanward. Very little is known about the sequence of sediments but in northern Yukon up to 30,000 feet of Mesozoic rocks are present. On the Continental Shelf, it is expected that Tertiary sediments overlie the Mesozoic so the combined thickness could be considerable greater.

The Continental Shelf (see Map No. 1) extends between two to three hundred miles west of the islands and although a potential oil and gas province, the permanent polar-ice conditions may place severe restrictions on exploration in offshore areas.

Eagle Plain

The Eagle Plain is one of several complex structural basins in the northern Yukon. The area from the Ogilvie Mountains to the Arctic Coastal Plains is underlain by a thick succession of sedimentary rocks representing most of the geologic systems. The principal rocks of interest are late Paleozoic to Mesozoic which consist of porous carbonates and thick sequences of sandstone. Oil and gas were discovered in two wells and oil in one well, all in rocks of Pennsylvanian age.

Geologic structures in the Eagle Plain are parallel to the mountain ranges such as the Richardson, Old Crow and Keele Ranges. They consist of broad north-south trending folds, many on echelon patterns. Strong regional unconformities separate rocks of each system thus producing many potential stratigraphic traps for hydrocarbons. Several periods of

deformation have added to the complexities of the geology in the intermontane basins of northern Yukon.

Area and Volume of Sediments

In sedimentary areas, which are relatively unexplored by drilling, there are various ways in which an estimate of the possible oil and gas potential may be made. One of the more commonly used methods is that of estimating the volume of sediments within the basins and comparing these with other sedimentary basins of the world in more advanced stages of development.

The area of the islands underlain by sedimentary rocks is about 350,000 square miles. Since measured and estimated stratigraphic sections are widely dispersed, an approximation for the average thickness was taken to be 10,000 feet. For purposes of computing the volume of sediments, only the areas between the 1,000 feet isopachous lines were used, and the thickness sedimentary sections were used, and the thickest sedimentary sections were taken to 16,000 feet. Below 16,000 feet, very few wells are productive from the older sediments, although younger sediments at this depth may provide excellent reservoirs. On this basis the volume of sediments in the Northwest Territories and Yukon is approximately 332,000 cubic miles.

A comparison of the sedimentary areas and volumes in the Western Provinces and in the Yukon, Northwest Territories and Arctic Islands is given in Table No. 1.

TABLE NO. 1
Volume of Sediments

<u>Area</u>	<u>Area (Sq. Miles)</u>	<u>Volume of Sediments (Cu. Miles)</u>
Manitoba and Saskatchewan	176,623	168,072
Alberta	236,893	341,715
British Columbia	50,688	115,318
Yukon	43,000	64,500
Northwest Territories	204,794	267,033
Arctic Islands	350,000	663,500
	1,061,998	1,620,238

Oil and Gas Discoveries

Norman Wells is the only producing oil field North of the 60th parallel. The field was discovered in 1920, but intensive commercial development did not take place until World War II. During 1970 oil was produced at an average rate of 2614 barrels daily and refined locally.

Imperial Oil discovered oil at their Atkinson H-25 well in January 1970. A company announcement stated that "Oil flowed to the surface from the 5700 foot level. Further testing is required to evaluate this field". Offsetting wells, nearest one about 3-1/2 miles away, were dry and abandoned.

To date, gas has been discovered in 9 separate areas on the Northwest Territories Mainland and in two wells in the Arctic Islands. Pointed Mountain is the only gas field



Photograph No. 2 — Gas bubbling in Northern Lake in N.W.T.

currently under development; a fourth well Pan Am Pointed Mountain 0-46 is drilling a northern extension to the field. The field will go on stream on November 1, 1972, when a pipeline to be built during the winter of 1971-72 will tie in into the Fort Nelson-Beaver River gas pipeline.

In the Arctic Islands, significant gas discoveries were made by Panarctic Oils Ltd. at Drake Point on Sabine Peninsula and on King Christian Island. These gas discoveries will be evaluated in the near future, to determine the areal extent of the reservoirs.

Significant gas discoveries were made on the Eagle Plain and a northern extension to the Beaver River gas field in the Yukon. The Beaver River gas field will go on stream on November 1, 1971.

In the Eagle Plain, four gas wells were drilled and suspended after the discovery of oil and gas at the Western Mineral Chance, Y.T. No. 1 (M-08) well in 1960. Lack of potential markets have deterred the development of these wells. (See Appendix II for complete text of Oil and Gas Discoveries).

Reserves

A. Crude Oil Reserves

The geological basins comprising the Territories and Arctic Islands are only in the initial stages of exploration, so definitive crude oil reserves have little meaning at this time. However, The "Potential Reserves of Crude Oil Recoverable by Conventional Methods", compiled by the Canadian Petroleum Association, and released in April, 1969, are considered authoritative. The Canadian Petroleum Association report states that the potential crude oil reserves for "all of Canada recoverable by conventional means is 120.8 billion barrels, of this total, 43.45 billion barrels is assigned to the Arctic Islands and Coastal Plain area; and (by interpolation) approximately 15 billion barrels are calculated for the rest of the Northwest Territories and the Yukon Territory. Thus, about 60 billion barrels of oil, or 50% of the total potential of Canada was computed to be located North of 60.

The Association, in an annual report outlining the reserves for Canada, states that at December 1, 1970 proved reserves assigned to the Northwest Territories (Norman Wells field) were 45.21 million barrels".

The "Potential Reserves" of Canada as reported by the Canadian Petroleum Association is the most authoritative estimate available.

In the April 1969 report, the "Potential Raw Gas Reserves" for Canada are given as 724.8 trillion cubic feet. The potential reserves computed for the Arctic Islands are 260.7 trillion cubic feet; those for the rest of the Northwest Territories and the Yukon Territory (by interpolation) are calculated at approximately 90 trillion cubic feet.

Recent reports of reserves are given by the Canadian Petroleum Association as 1.006 tcf Proved and 1.403 tcf Proved and Probable for the Pointed Mountain gas field. The report did not assign any gas reserves to the Yukon portion of the Beaver River gas field, to 12 individual gaswell discoveries in the Yukon and Northwest Territories or to the two gas discoveries in the Arctic Islands.

REFINING OPERATION

Refining Capacity

As noted in a previous section the only operating refinery located north of 60 is at Norman Wells and is operated by Imperial Oil Ltd. This refinery has a calendar day capacity of 1,500 barrels and a stream day capacity of 1,600 barrels. An extensive modernization program to increase refining capacity to more than 2,000 barrels per day was commenced in 1969 and should be completed in 1971. In addition, other facilities such as barrel-filling, wharf-loading and water-purifier will be enlarged and improved.

ACTIVITIES – 1970

Land

As may be seen in the land map (Map No. 1), Figure No. 1, and in Table No. 2, 1970 was characterized by additional filings in the Arctic Islands, Davis Strait and on the mainland of the Northwest Territories. Periferal acreage was surrendered in seacoast areas on the Continental Shelf and along the eastern margins of the Interior Plains basins.

TABLE NO. 2
Number of Permits and Leases and
Relevant Acreage – 31 December 1970

Area	PERMITS	
	No.	Acreage
N.W.T. Mainland	2,353	107,746,820
Y.T. Mainland	627	26,722,941
Arctic Islands ⁽¹⁾		
off-shore (N of 70)	3,180	156,263,213
on-shore (N of 70)	2,032	100,575,187
Arctic Coast Marine ⁽²⁾	908	48,274,444
	9,100	439,582,505
LEASES		
N.W.T. Mainland	614	3,690,088
Y.T. Mainland	63	252,222
Arctic Islands ⁽¹⁾	—	—
Arctic Coast Marine ⁽²⁾	—	—
	673	3,942,210

(1) All areas North of 70°

(2) All areas South of 70° covered by seacoast waters.

The net result was that the number of Permits terminated exceeded the number of N.W.T. issues in the mainland areas of the Territories by 72 permits and in the Yukon by 48 permits. A small decline in total acreage was evident in the Arctic North of 70, primarily from termination of sizable holdings on the outer Continental Shelf in the Beaufort Sea and Queen Elizabeth Islands.

Canada Lands are administered by the Department of Indian Affairs and Northern Development northward of the heavy line. Offshore areas elsewhere administered by the Department of Energy, Mines and Resources

Map 2
OIL & GAS LAND ACQUISITIONS
NORTH OF 60°

Scale of Miles
 100 0 100 200 300

[Dotted pattern] Acquired prior to 1968
 [Hatched pattern] Acquired Jan. 1, 1968 to Dec. 31, 1970.
 • Oil Well
 ☼ Gas Well

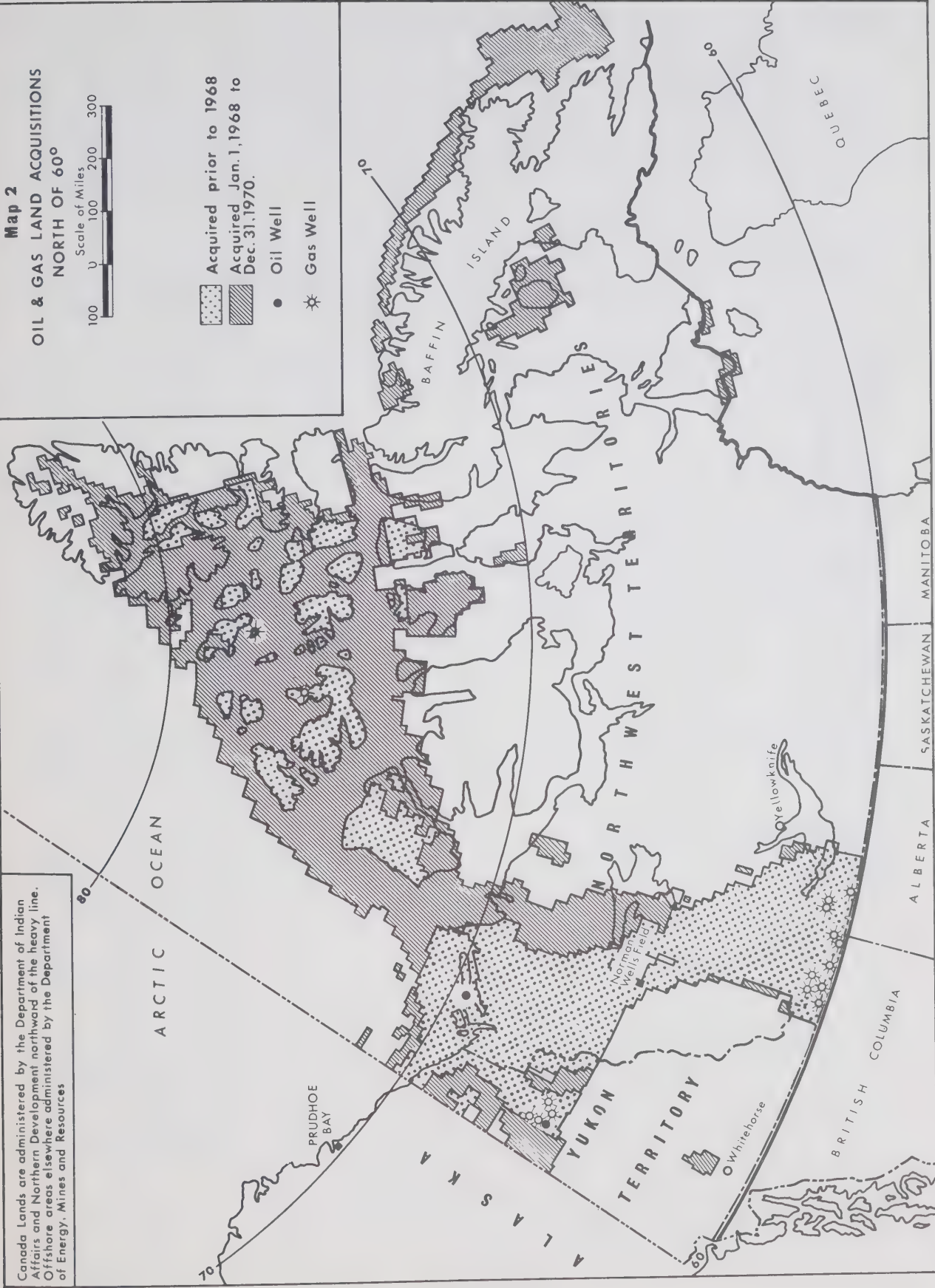
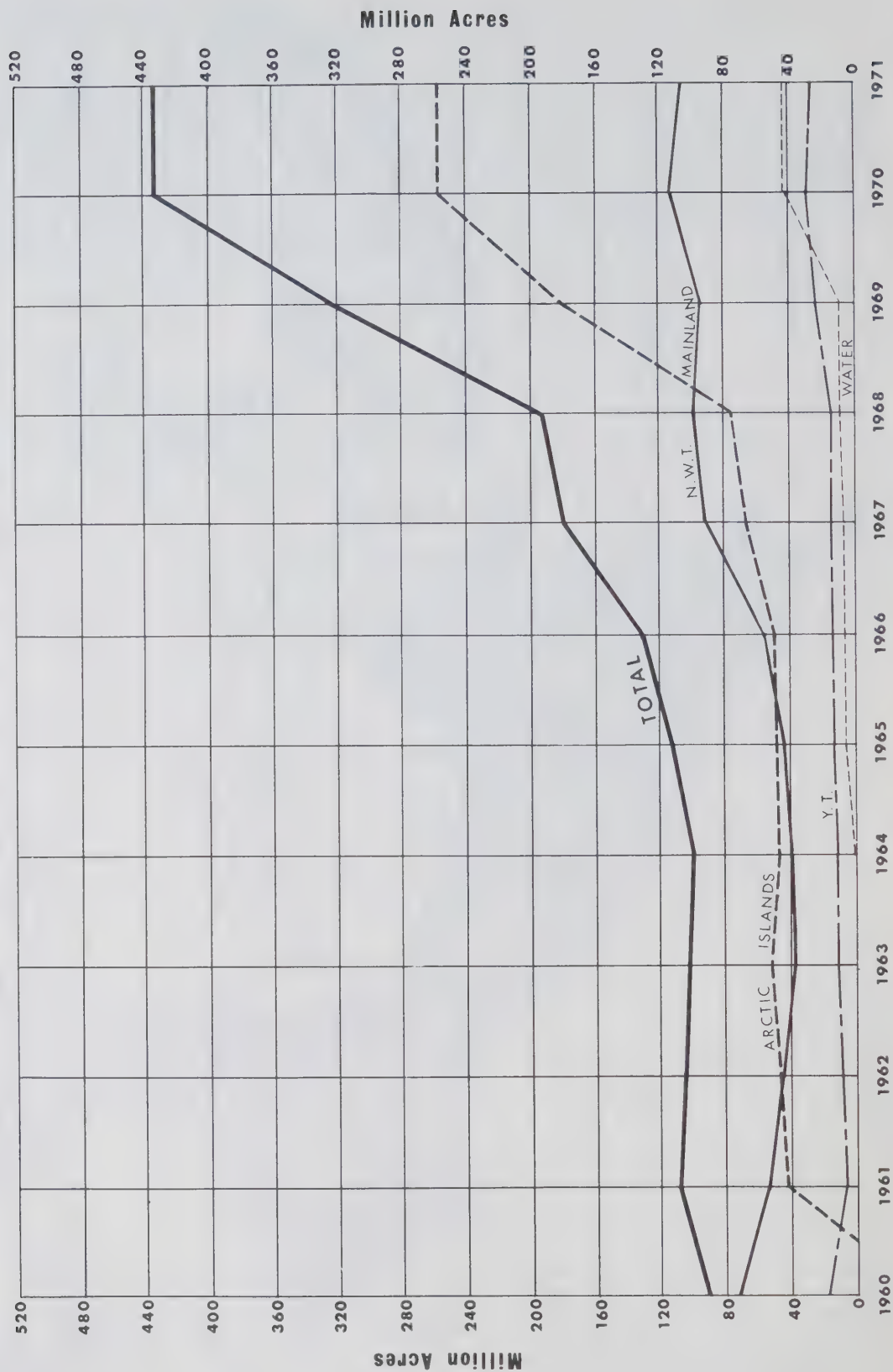


Fig. 1
ACREAGE HELD UNDER OIL & GAS PERMIT
 YUKON TERRITORY AND NORTHWEST TERRITORIES



Interest continued in the Davis Strait and Baffin Bay areas where industry acquired 176 permits covering 9,378,008 acres.

As a result of the maturing permits in the southern mainland areas, the number of leases held by industry increased by more than one million acres in 210 leases. This increase in lease holdings contributed to the decline in the number of mainland permits. The trend of leasing illustrated in Figure No. 2 is expected to continue throughout 1971 and accelerate in 1972 and in later years.

No major changes in the overall industry holdings in the primary sedimentary areas are anticipated before mid-year 1972, however, new developments could substantially affect the holdings in seacoast areas, particularly those in Foxe Basin, the Davis Strait and Baffin Bay. No public offerings of oil and gas rights were made during 1970.

Rentals increased for oil and gas leases in the Northwest Territories by \$2,800,000 and by \$150,000 in the Yukon Territory, during the calendar year 1970 over the previous year. Rentals and special rental fees should increase in 1971 to a new high of about 5 million dollars.

Oil and Gas Regulations

The only amendment to the Canada Oil and Gas Land Regulations in 1970, was the revocation of Land Order 1-1961. Under this order, a permittee following the lease selection, was granted an exclusive 60-day option to acquire leases on the Crown Reserve lands in the permit area. These leases carried a sliding-scale royalty in addition to the royalties prescribed in the Regulations. Under the amended Regulations Crown Reserves must be disposed of under the terms of Section 58, and Land Orders Nos. 2-1961, and 1-1962.

Permit Term and Work Requirement Zones are illustrated in Figure No. 3. Note that permit terms for water permits west of Longitude 90° are slightly different from those east of 90°. In Figure No. 4 the Permit Term and Deposit Requirement are graphically described. There have been no changes since 1968.

Land Order No. 1-1961 prior to Revocation set out a schedule of Additional Rates by Areas. These are shown in Figure No. 5. Figure No. 6 is a Flow Diagram of Disposal of Oil and Gas Rights. It also illustrates the primary disposal of permits and leases, and shows the methods of acquiring leases by tender.

Exploration

Figures 7, 8, 9 and 10 graphically depict exploration activities North of 60 in 1970. Expenditures on oil and gas exploration in the Northwest Territories and Yukon Territory exceeded 126 million dollars in 1970, an increase of about 40 million dollars over the previous year. Exploratory and development drilling expenditures increased 45%, up to 55 million dollars, while total geological and geophysical increased 55% to over 58 million dollars. Expenditures for seismic exploration exceeded similar work in every province and the combined Atlantic and Pacific offshore areas.

Figure No. 7 indicates that expenditures increased by 40% in 1969 and again by 40% in 1970. Indications to mid-year 1971 are that these expenditures will again increase in 1971, best estimates are that they may approximate 150 million dollars. By 1975 expenditures related to oil and gas activities should reach 200 million dollars per year.



Photograph No. 3 — Camp for geologists carrying out surface work in the Yukon Territory

Fig. 2
YUKON TERRITORY - NORTHWEST TERRITORIES
ACREAGE UNDER LEASE
BY YEAR

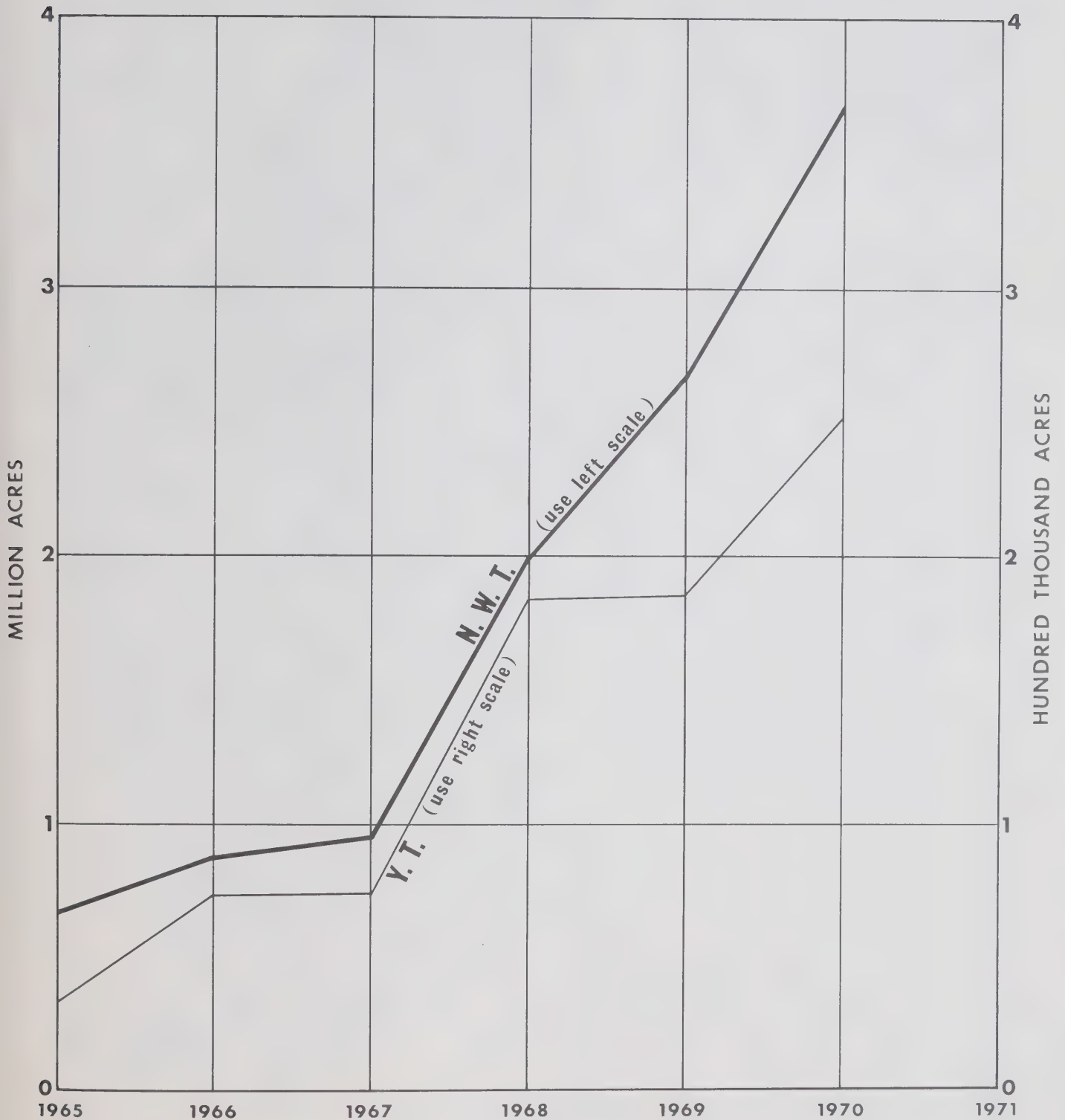


Fig.3

PERMIT TERM AND WORK

REQUIREMENT ZONES

NORTH OF 60°

\$ 2.65/AC.

\$ 2.70/AC.

\$ 2.90/AC.

Scale in miles

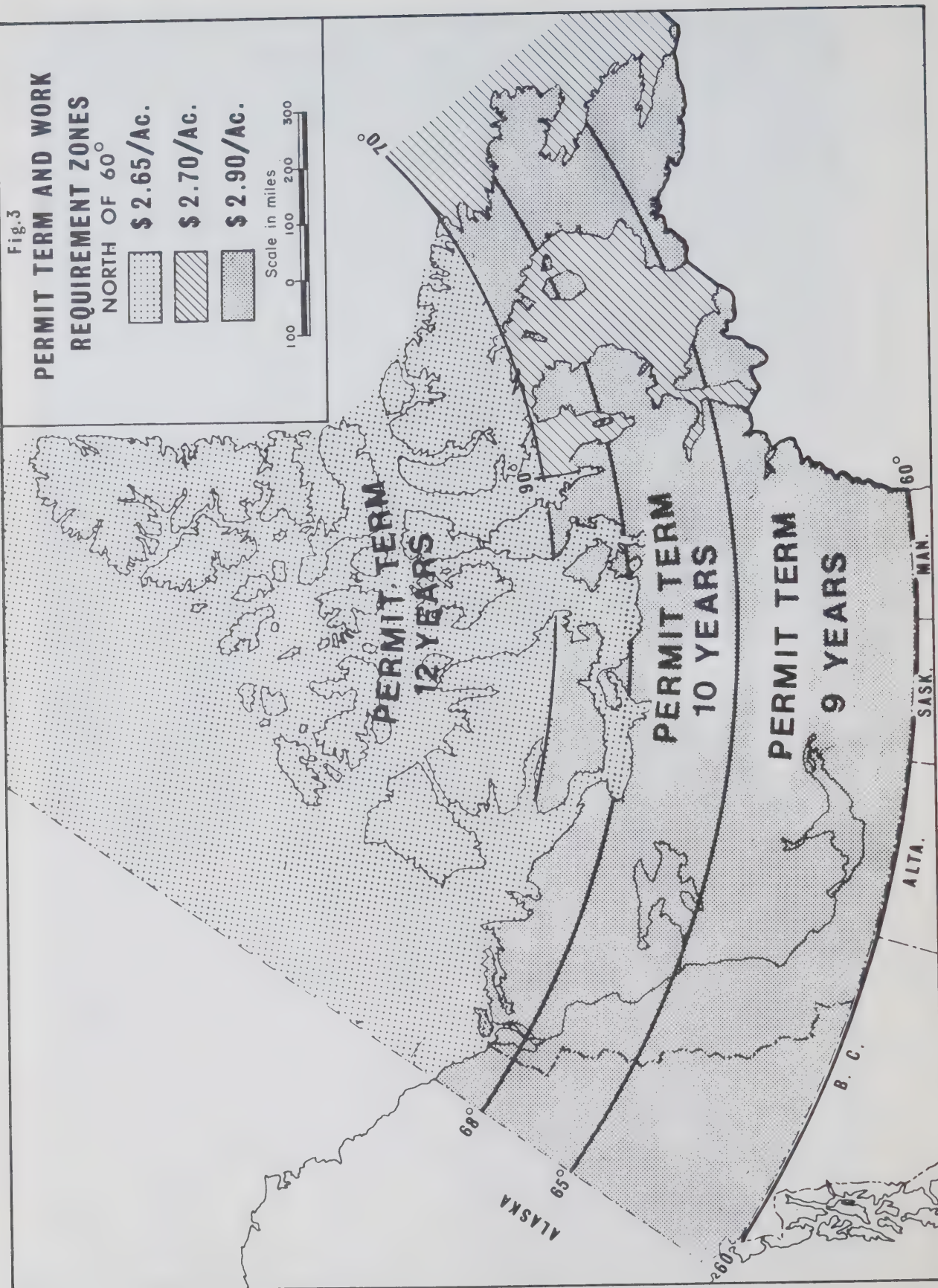


Fig. 4

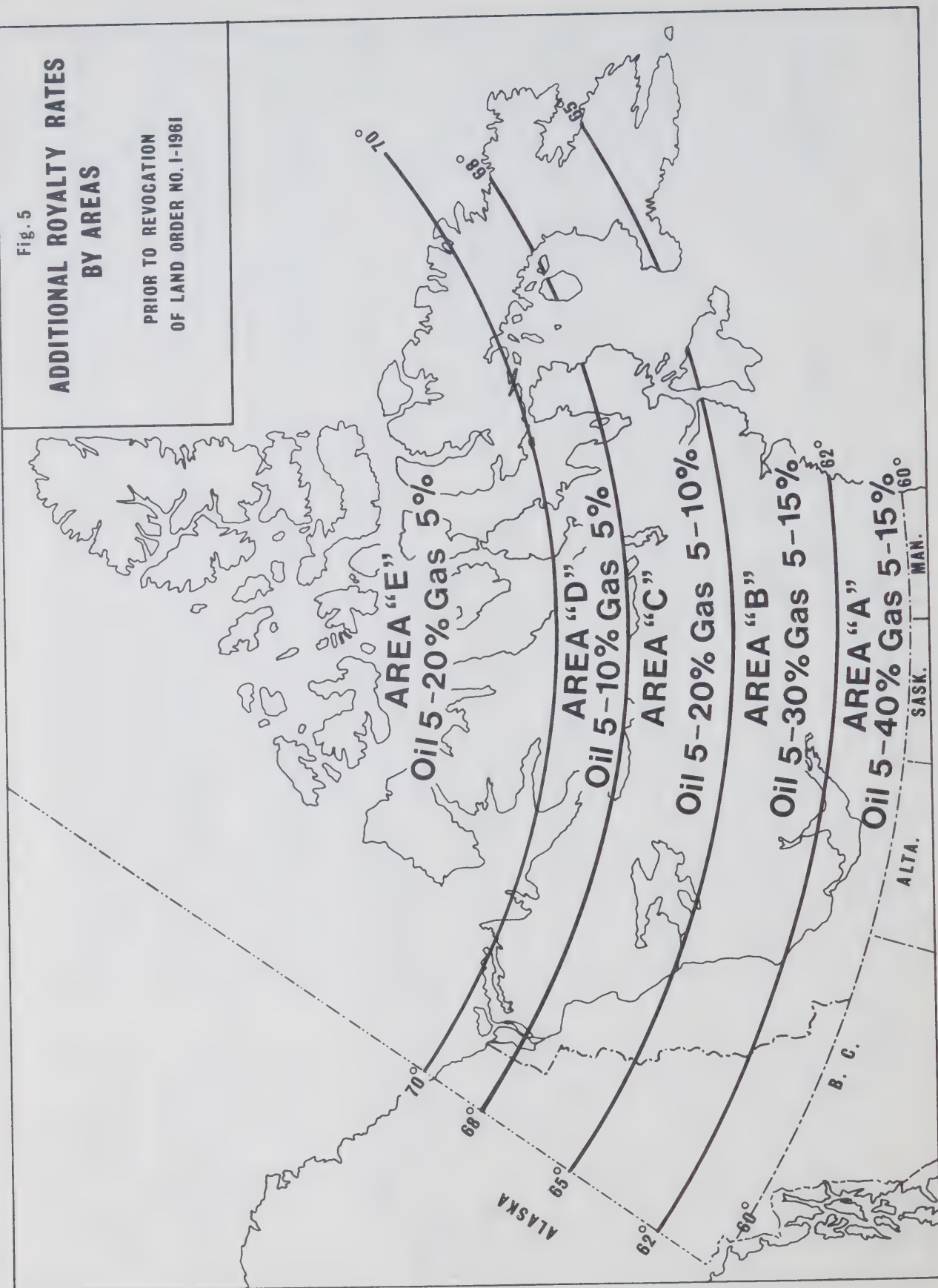
YUKON TERRITORY - NORTHWEST TERRITORIES
PERMIT TERMS AND DEPOSIT REQUIREMENTS — PER ACRE

PERMITS LOCATED BETWEEN LATITUDES	RENEWAL TERMS														TOTAL WORK REQUIREMENTS
	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs	
60° - 65°	3 YEARS														\$ 2.90
	5¢ 15¢ 30¢ 40¢ 50¢ 50¢ 50¢ 50¢														
	4 YEARS														
65° - 68°	5¢ 15¢ 30¢ 40¢ 50¢ 50¢ 50¢ 50¢														\$ 2.90
	6 YEARS														
	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														
68° - 70°	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														\$ 2.90
	6 YEARS														
	5¢ 15¢ 20¢ 40¢ 50¢ 50¢ 50¢ 50¢														
NORTH OF 70°	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														\$ 2.65
	6 YEARS														
	5¢ 15¢ 20¢ 40¢ 50¢ 50¢ 50¢ 50¢														
MARINE PERMITS LOCATED SOUTH OF 70° N WEST OF 90° W	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														\$ 2.65
	6 YEARS														
	5¢ 15¢ 20¢ 40¢ 50¢ 50¢ 50¢ 50¢														
SOUTH OF 70° N EAST OF 90° W	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														\$ 2.70
	6 YEARS														
	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														
PERMITS LOCATED NORTH OF 70° ISSUED PRIOR TO 1968	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														\$ 2.65
	8 YEARS														
	5¢ 15¢ 20¢ 20¢ 20¢ 40¢ 50¢ 50¢														
MARINE PERMITS SOUTH OF 70° ISSUED PRIOR TO 1969	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														\$ 2.70
	6 YEARS														
	5¢ 15¢ 20¢ 30¢ 50¢ 50¢ 50¢ 50¢														

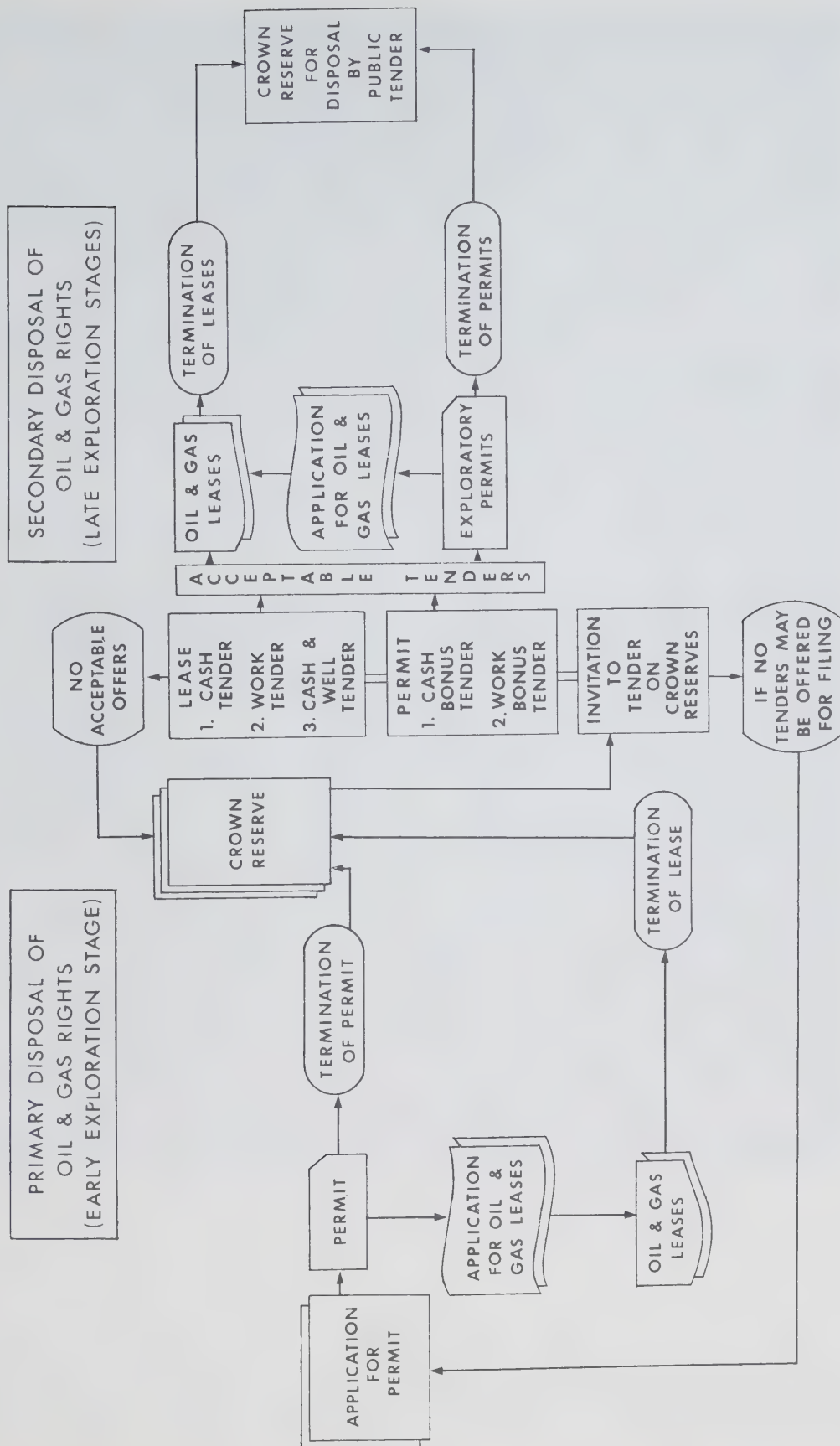
Fig. 5

ADDITIONAL ROYALTY RATES BY AREAS

**PRIOR TO REVOCATION
OF LAND ORDER NO. 1-1961**



FLOW DIAGRAM OF DISPOSAL OF OIL AND GAS RIGHTS





Photograph No. 4 — Seismic drill crew at work in the Reindeer area — N.W.T.

Seismic crew months, depicted in Figure No. 8, is an excellent barometer on the magnitude and drilling activity for the next two years. In 1970, oil companies conducted 235 crew months of seismic work on land and marine areas, an increase of 50% over the previous year. This would indicate that drilling activity should increase substantially in 1971 and 1972.

Figures 9 and 10 illustrate the number of wells drilled and amount of footage drilled during the past 10 years. Note that footage has more than tripled since 1968. This is also reflected in the expenditure increase for drilling, in that there has been an eight fold increase in drilling expenditures during the same interval.

Operations

Significant acquisitions of acreage by application were made by several companies during 1970. Imperial Oil applied for over 6.1 million acres in Cumberland Sound, off Baffin Island. This was followed by Buttes Resources for 1.5 million acres in Jones Sound. On Victoria Island, Atlantic Richfield Oil Co. acquired 2.5 million acres. Scattered acreage in small lots was acquired in many areas by a variety of companies and individuals.

Permits were surrendered or cancelled along the periphery of many basins on the Mainland and Arctic Islands. The largest single surrender six million acres was made by the Hunt Bros. of permits located off the Continental Shelf in the Beaufort Sea.

Surface geological and photogeological surveys totalling 135 geological crew months were carried out on Canada lands North of 60. Participation surveys by V. Zay Smith and Associates, Geophoto Services Limited and J.C. Sproule contributed significantly to the total surface exploration program. Imperial Oil Ltd. continued surface exploration in the northern Yukon Territory and Northwest Territories, while Panarctic Oil Ltd. and Atlantic Richfield Oil Company continued major mapping programs on the Arctic Islands.

Seismic activity was general over many of the geological basins in the north. Detailed seismic work was carried out by many companies in the southern part of the Northwest Territories and on the Peel Plateau. Imperial Oil Enterprises, Gulf Oil Canada Ltd. and Shell Oil Canada continued to carry out large reflection programs along the Arctic Coastal Plain and in the general Mackenzie Delta areas. Three companies carried out several programs south and east of the Old Crow village on the Peel Plateau.

Major seismic programs were initiated by Elf Oil Canada and Deminex on Banks Island, while Panarctic Oils Ltd., BP Oil and Gas Exploration and Sun Oil Company undertook large scale reflection programs over the central and western Arctic Islands.

Drilling activity was highlighted by large and extensive drilling programs in the Tuk-Delta areas and Arctic Islands. In the Tuktoyaktuk areas Imperial Oil Enterprises continued to drill stratigraphic tests. One of the wells, Imperial Atkinson H-25 recovered oil. Imperial Oil in a press release stated that "Oil flowed to the surface from the 5700 foot level. Further testing is required to evaluate this field". The company drilled two wells approximately three and a half and seven miles from the discovery well without finding oil or gas.

In the Arctic Islands Panarctic Oils Ltd. drilled and completed or abandoned seven wells during 1970. One of the wells, Panarctic Drake Point L-67 was suspended as a completed gas well on February 26, 1970. On King Christian Island a well King Christian D-18 was spudded on October 14, 1970 and drilled to a depth of 2,010 feet when gas blew out, caught fire and destroyed the rig. A second rig was flown in and spudded a relief well



Photograph No. 5 — Seismic camp in Arctic Islands

Fig. 7

OIL & GAS EXPLORATION EXPENDITURES

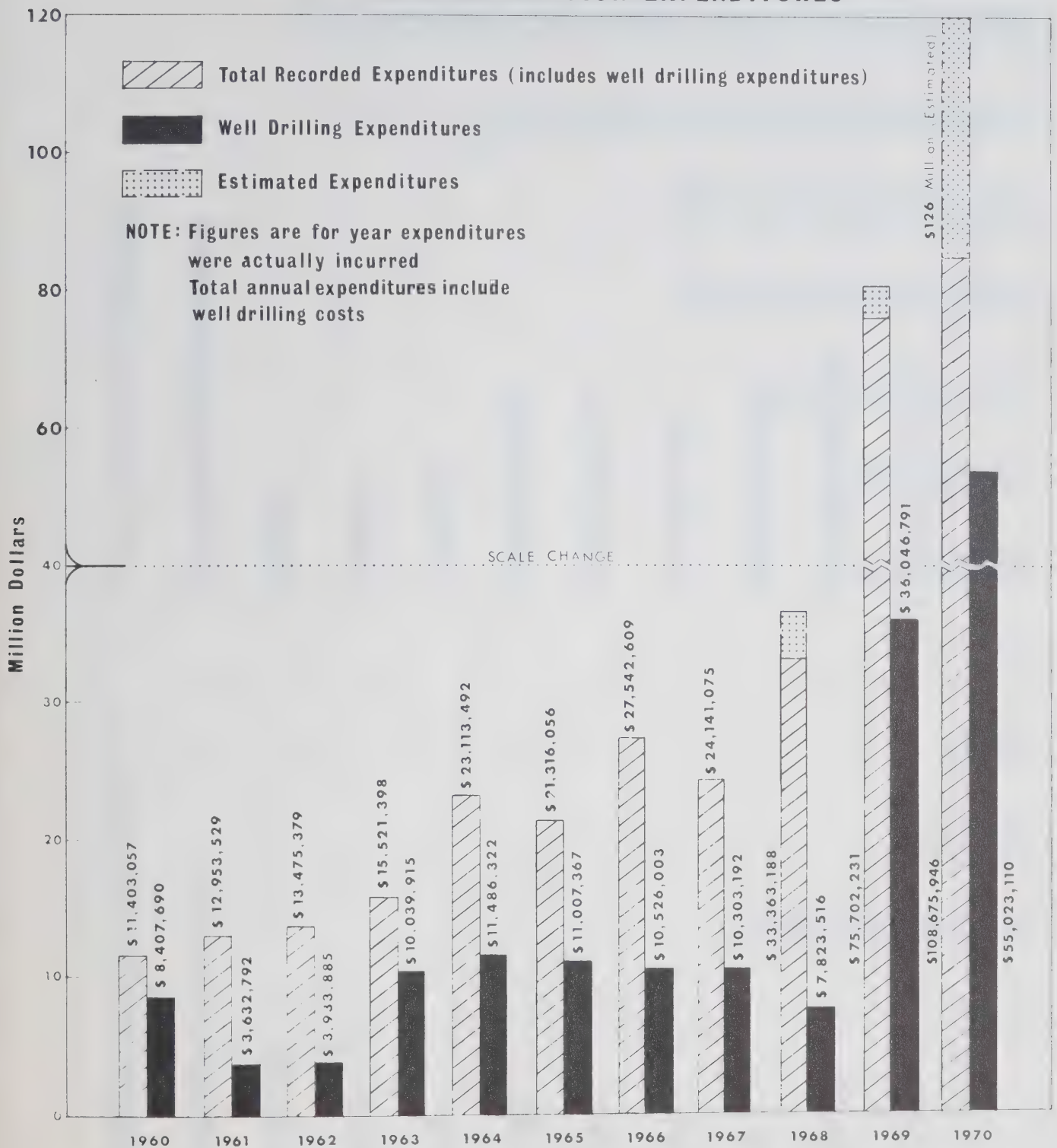


Fig. 8

EXPLORATION ACTIVITY
YUKON TERRITORY AND NORTHWEST TERRITORIES

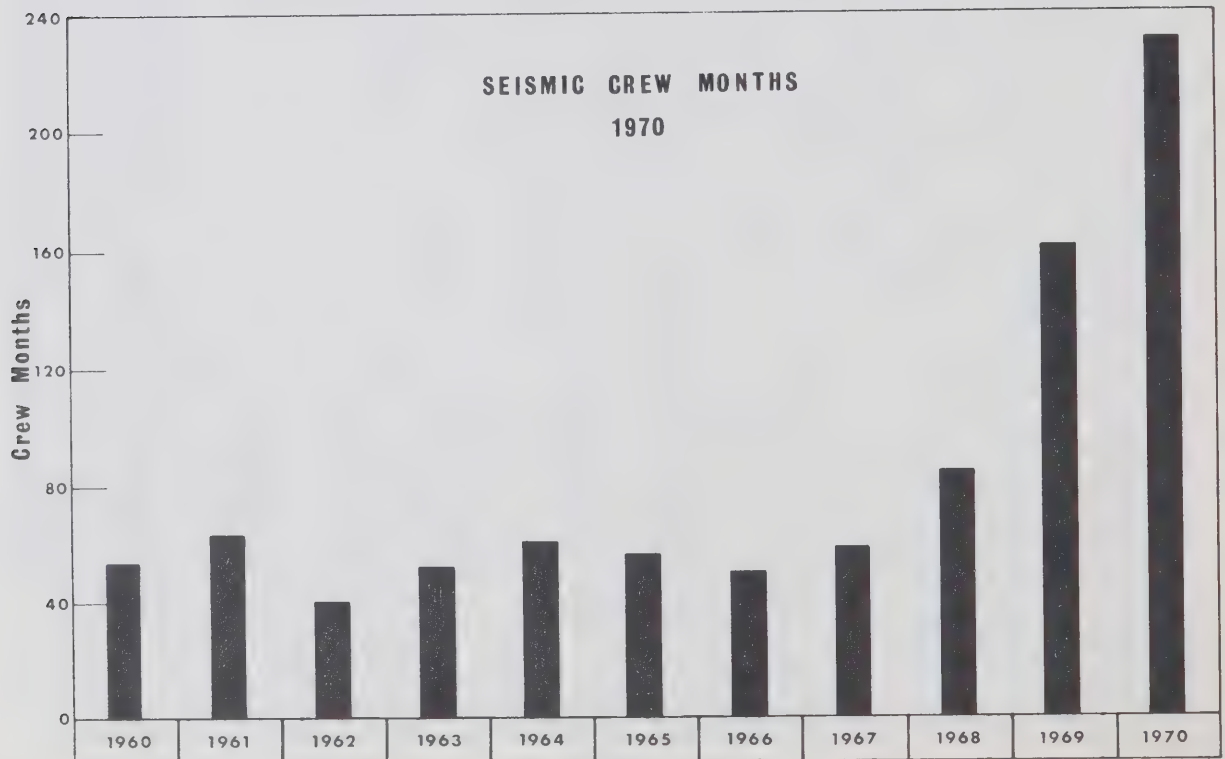
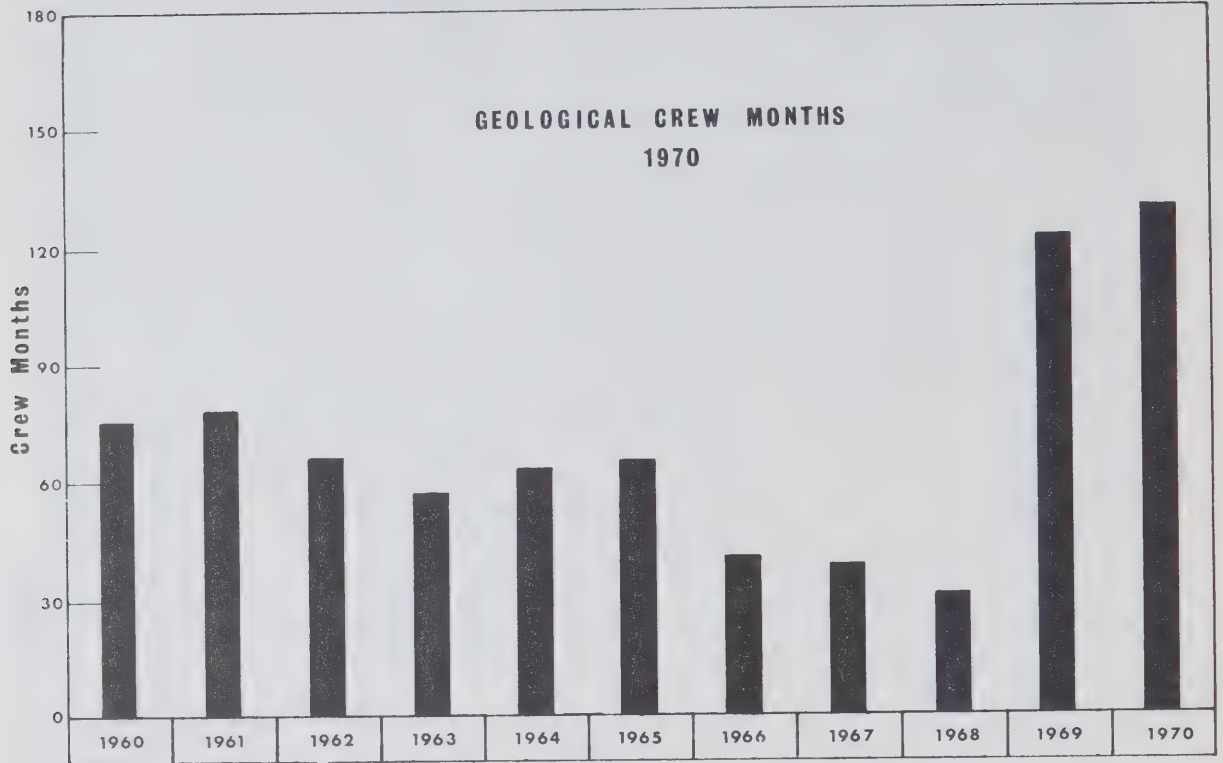


Fig. 9

WELLS DRILLED
YUKON TERRITORY - NORTHWEST TERRITORIES
Number of Wells Drilled to end 1970, 504

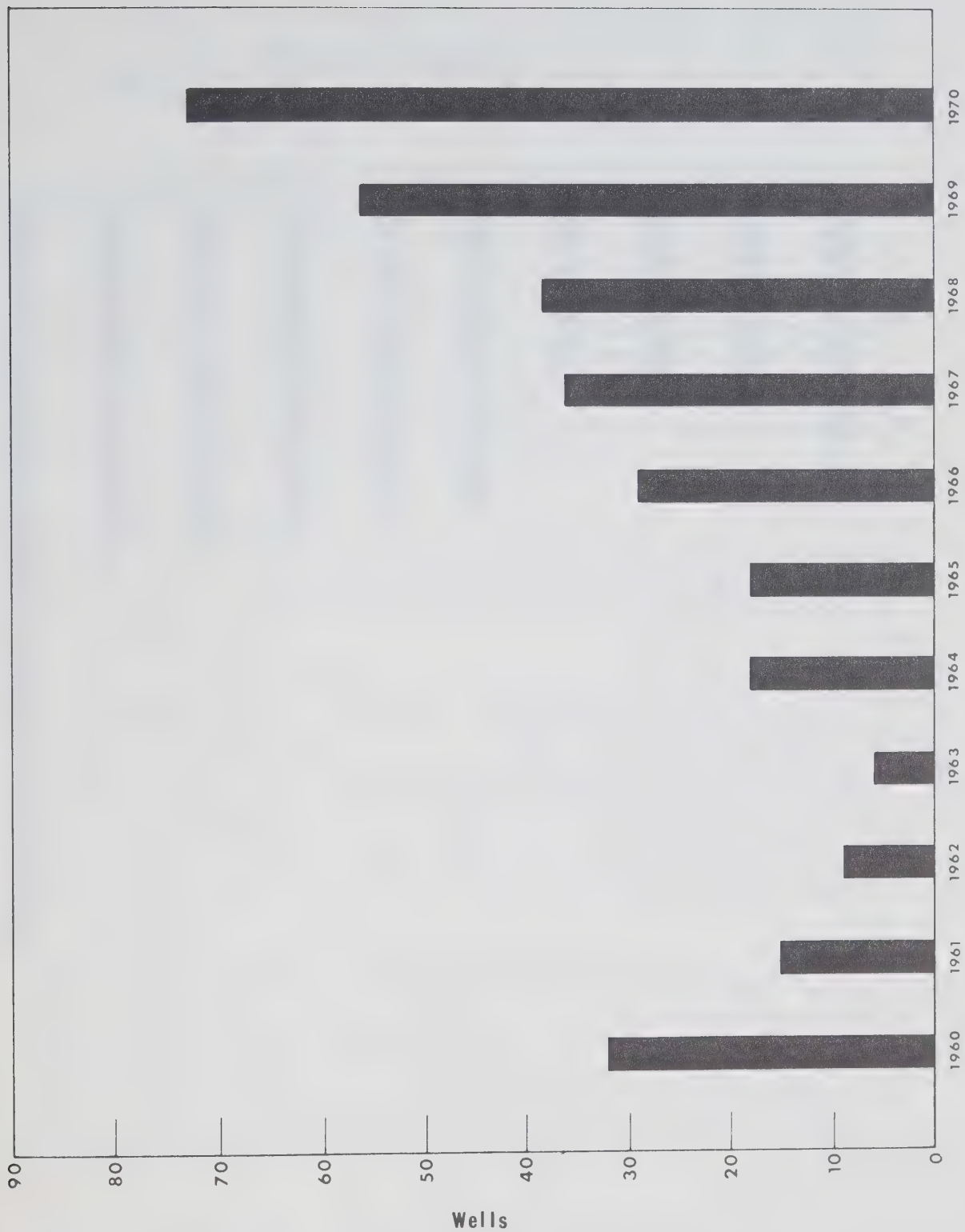
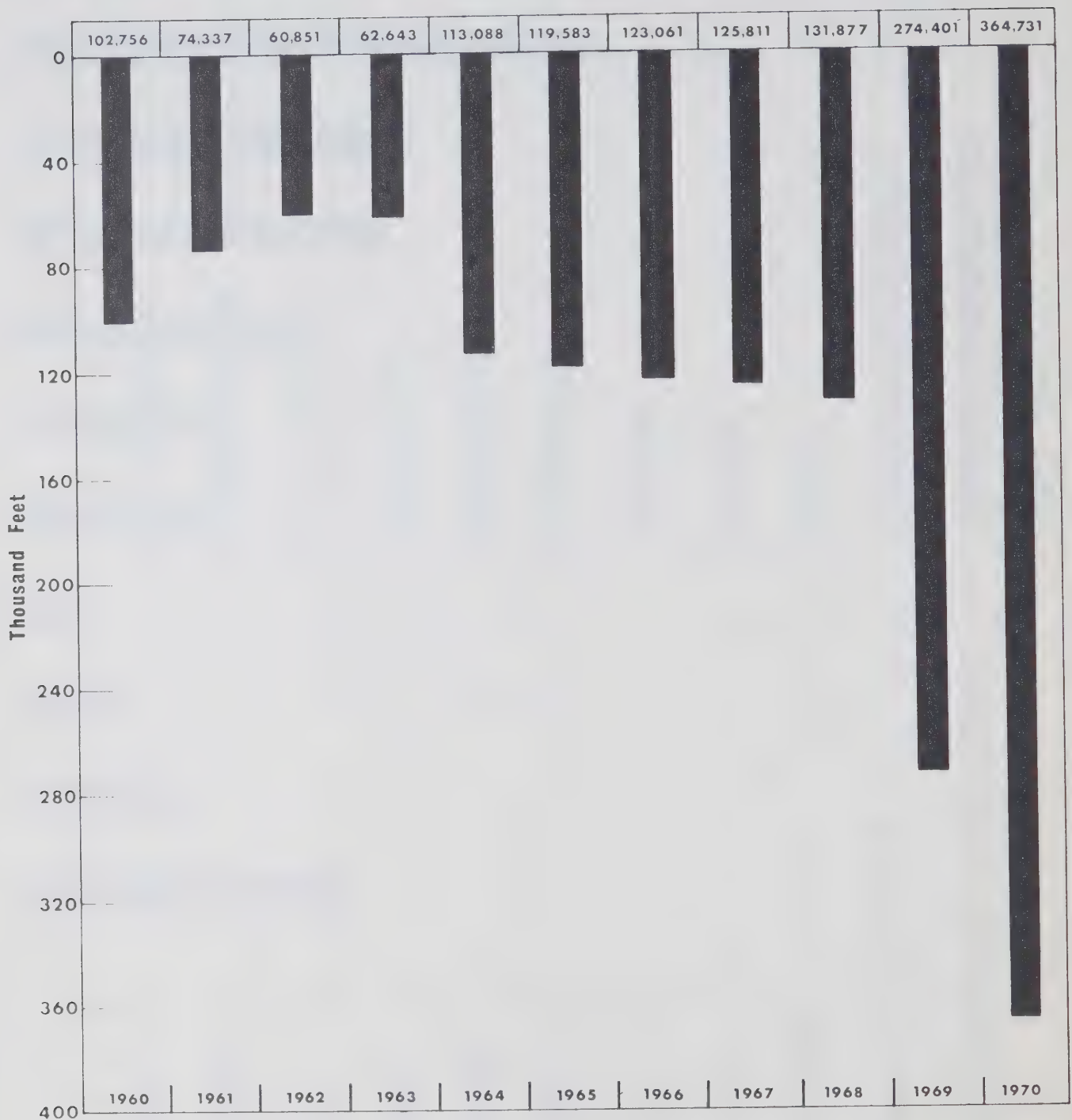


Fig. 10

FOOTAGE DRILLED

YUKON TERRITORY AND NORTHWEST TERRITORIES



on November 26, 1970. At the year's end the well was near its total depth of 2,090 feet and preparations were made to put out the fire and kill the gas flow. Proposed drilling operations for 1971 will be continued with four rigs; one medium sized rig will be flown to the King Christian location and a third medium sized rig will be moved to Fosheim Peninsula.

In the Yukon Territory, Imperial Oil drilled and abandoned a 14,000 foot wildcat well at Blow River, on Eagle Plain, Western Minerals drilled a 14,500 foot well but it had to be abandoned without finding hydrocarbons.

The number of "wells drilled" and seismic "crew months" worked will increase during 1971. Extensive seismic programs will be carried out in the Beaufort Sea and with ice breaker assistance in the Viscount Melville Sound and Norwegian Bay areas. The continuation of wildcat drilling in the Arctic by Panarctic, Sun Oil and BP, the wildcat drilling in the Delta areas by the major companies, the participation drilling program by Horn River Resources will increase the number of wells drilled to at least 80 in 1971. Drilling activities and seismic programs will increase substantially in the other areas and total exploration expenditures may exceed 150 million dollars in 1971.

Participation and Research Projects

Approximately 20 participation and research-type projects were initiated or continued during 1970. Expenditures incurred for these projects qualify for work credits and when approved can be applied to permits in certain designated areas. Major programs in these categories during 1970 were:

- 1) *Arcticquest* is a geological and geophysical program designed to solve fundamental geologic problems in order that exploring companies can proceed with individual surveys having a background of stratigraphic control and geophysical technique in unexplored areas. The program will systematically explore the regions between the mainland and Banks Island, new techniques in geophysics may be developed. The information derived should provide an insight into the sedimentary and structural conditions for companies planning additional geophysical or drilling programs. Eleven separate programs are being carried out which consist of eight marine seismic projects, a surface project, an aeromagnetic program, and a study relating to the environment.
- 2) *Polarquest* is a 4 to 5 year program of reconnaissance surveys in the Arctic and surrounding waters. Programs in 1970 consisted of regional geology, aeromagnetic, gravity, environmental studies, and a collection of bathymetric data. These surveys will provide the basic information which would be used to evaluate the sedimentary basins and allow for detail planning by the permittees on their specific areas of interest. In 1971 Polarquest will undertake two extensive common-depth-point marine seismic programs in the inter-island areas of the Eastern Sverdrup Basin and in the Parry Channel. In addition, surface surveys will be undertaken over most of the Arctic Islands.
- 3) *Sigma Seismic Programs* — Sigma Geophysical Limited carried out 2 large reconnaissance seismic programs, one was in the area between latitude 65° to 68° east of the MacKenzie River, the second program was centered between latitude 62° and 65° west of the MacKenzie River. Information from these surveys is made available to all interested parties. The permittees acquiring this information by the purchase of data may apply their expenditures to permits encompassed by the area covered by the surveys.

4) *Arctic Petroleum Operators Association*

The Association is composed of 24 oil companies who hold permits in the Beaufort Sea area. The objectives are to develop the necessary operating technology for the Arctic to engage in studies related to ecological and conservation programs and to act as liaison between other research agencies relative to Arctic operations. Since its inception in January 1970, 16 APOA projects have been completed or are currently underway. The total cost of the projects is approximately 1.5 million dollars. Some of the major programs are preparing drilling guidelines for the Arctic and offshore areas; carrying out a feasibility study for light-weight drilling rig specifically for the Arctic; assisting with an oil spill contingency plan and studying characteristics and movement of ice in the Beaufort Sea.

EXPLORATION-ITEMS OF INTEREST

Oil and Gas Production and Conservation Act

The need for an Oil and Gas Production and Conservation Act to provide statutory authority for control of oil and gas production, prevention of waste and safety of operations in the North was recognized in the Oil and Gas Production and Conservation Act that became law on June 27, 1969. This Act, confined initially to the Yukon and Northwest Territories was extended to cover all of Canada outside of the provisions on June 11, 1970.

Norman Wells Agreement and Refinery Operations

The Canadian Government entered into an agreement with Imperial Oil Limited on June 30, 1944 for the purchase of oil products produced at its Norman Wells refinery, the Company's only operating refinery located North of 60. This refinery has a calendar day capacity of 1,500 barrels and a stream day capacity of 1,600 barrels. An extensive modernization program to increase capacity to more than 2,000 barrels a day was begun in 1969. In 1970 Imperial Oil planned to spend 2.5 million dollars on its manufacturing and marketing facilities in the Northwest Territories. The refinery in Norman Wells is being modernized, refinery input increased, more storage tanks added, and additional barrel filling facilities constructed. In an effort to guarantee the purity of the coolant water being returned to the Mackenzie River, an effluent separator will be installed.

Gas Purchase Agreement

The Westcoast Transmission Company and Amoco Canada Limited have signed a contract for dedication of the company's developed gas reserves in the Beaver River Field straddling the British Columbia – Yukon and at Pointed Mountain in the south-west sector of the Northwest Territories.

The reserves proved and those developed in the Beaver River – Pointed Mountain area are needed by Westcoast Transmission to help in meeting additional market requirements expected over a 25-year period. A 24-inch gas pipeline extending north for 110 miles from the present terminus of Westcoast Pipeline Company at Fort Nelson to the Beaver River gas pool has been completed during the past winter. The gas dehydrator plant and a gas gathering system in the Beaver River Field will be completed and on stream by November 1, 1971. Initial gas deliveries from Beaver River may exceed 200 MMcfd. A second contract for the construction of a gas dehydrator plant at Pointed Mountain and a connecting pipeline to Beaver River has been let. This section of the gas gathering facilities will be on stream by November 1, 1972.

When the development programs are completed it is likely that royalties from gas sales in the tri-corner of British Columbia, Yukon Territory and the Northwest Territories area will exceed one million dollars by 1975.

Land Use Regulations

In June, 1970, amendments to the Territorial Lands Act were passed by Parliament and these will permit the implementation of Territorial Land Use Regulations.

The latter regulations, currently being drafted, will provide authority for designating Land Management Zones in the Yukon Territory and Northwest Territories. Within these zones all resource exploration and development operators will be required to take out land-use permits. The land use permits will stipulate the required measures to be followed by the operator to protect and prevent unnecessary disturbance of the affected terrain and ecosystems.

The Land Use Regulations will be Administered by the Water, Forest and Land Division of the Northern Economic Development Branch.

Mackenzie Valley Pipelines

One of the major markets for Prudhoe Bay Oil is the north-central United States. The most direct route from Prudhoe Bay in Alaska and the Mackenzie Delta area of Canada to the United States mid-west area is along the Mackenzie Valley, and a pipeline built along this route would provide transportation for oil and gas from northern Canada. Accordingly, a consortium of 16 oil exploration companies and two oil pipeline companies was formed to determine the technological and economic feasibility of constructing a 48-inch crude oil pipeline from the north slope of Alaska, up the Mackenzie Valley and on to Edmonton where it would connect with existing oil pipelines.

The initial research facility, a looped 2,000-foot test section of 48-inch pipe in an area of continuous permafrost near Inuvik, Northwest Territories has been completed. Oil at 160°F is being circulated through this section. Company officials indicate that it is technically feasible to construct oil pipelines over permafrost areas without causing excessive damage. It has been decided to continue the test facility at Inuvik until the end of 1971. Extensive research is also being undertaken, with regard to route selection and construction methods, with emphasis on protection of the ecology and environment.

Northwest Project Study Group

A group of oil companies and gas pipeline transmission companies have formed a consortium to build test and research facilities at Sans Sault Rapids on the Mackenzie River, in the Northwest Territories to study the feasibility of a proposed gas pipeline to central Canada and the mid-western United States. The Arctic test facility now under construction is part of the 12 billion dollar project to be undertaken by the Northwest Project Study Group.

Construction and operation of the facilities at Sans Sault is estimated to cost 3.5 million dollars. Under the program, engineers will:

- 1) Test gas pipelines in permafrost under operating conditions.
- 2) Test foundations for above ground structures.
- 3) Test effect of a gas pipeline on surface covered.
- 4) Study surface drainage problems
- 5) Test various materials, equipment and methods of pipeline construction.

William Brothers Canada Limited of Calgary are engineers for the research project and will supervise all testing at this Arctic test facility, which is expected to be in operation for at least two years.

Supply Depot Established in the Arctic Islands

A group of four companies headed by Cardwell Supply Limited established a large supply and maintenance depot at Resolute in the Arctic Islands. In 1970 the company moved close to 5,000 tons of cargo, which included fuel, cement and drilling materials for various oil companies undertaking drilling programs in the Arctic Islands. Facilities at Resolute are housed in air-supported structures which can be expanded readily if additional space is required by other oil companies. Kaps Oil Transport Limited established a supply depot for Elf Oil and Deminex Oil Limited at Johnson's Point on Banks Island. Supplies are moved by barge down the Mackenzie River and Beaufort Sea to Banks Island during the ice-free periods in August or September.

Fort Simpson – Inuvik Toll Road

A Calgary based company received government approval to construct and maintain a 750-mile winter toll-road in the Mackenzie River Valley to provide access to exploration areas in the Norman Wells and Mackenzie Delta – Tuk areas.

The company, Western Electronics Limited, began construction of the road shortly after freeze-up. It is expected that a 50 foot right-of-way will be opened to Norman Wells by the end of the year and the road completed to Inuvik in 1971. The company hopes that the winter road will provide a base for an all-weather road along the Mackenzie River.

Pipeline Guidelines for Northern Canada

Canadian government guidelines for construction and operation of northern oil and gas pipelines were announced jointly on August 13, 1970 by the Honourable Jean Chrétien, Minister of Indian Affairs and Northern Development, and the Honourable J.J. Greene, Minister of Energy, Mines and Resources.

The guidelines relate to pipelines tapping oil and gas resources North of the 60th degree of latitude in the Yukon Territory and the Northwest Territories and from Alaska. They establish requirements ranging from environmental protection, pollution control and Canadian ownership and participation, to training and employment of residents of the north. Initially, only one trunk line each for oil and gas will be permitted in the north within a "corridor" to be established at a future date."

Revenues

While no sales of oil and gas rights were held in 1970 revenues governing the Northern operations during the calendar year approximated 4.5 million dollars. (See Table 5 and Figure 12) Revenues from all sources for the fiscal year are shown in Table No. 4 and Figure No. 11. Figure No. 13 depicts the annual value of work bonus for oil and gas work bonus blocks and permits. Cumulative value of work bonus to the end of 1970 is approximately 59 million dollars.

Fig. 11

YUKON TERRITORY-NORTHWEST TERRITORIES

GROSS REVENUE-OIL & GAS FROM

CASH BONUS BIDS, FEES, FORFEITURES
ROYALTIES, RENTALS & SALE OF MAPS

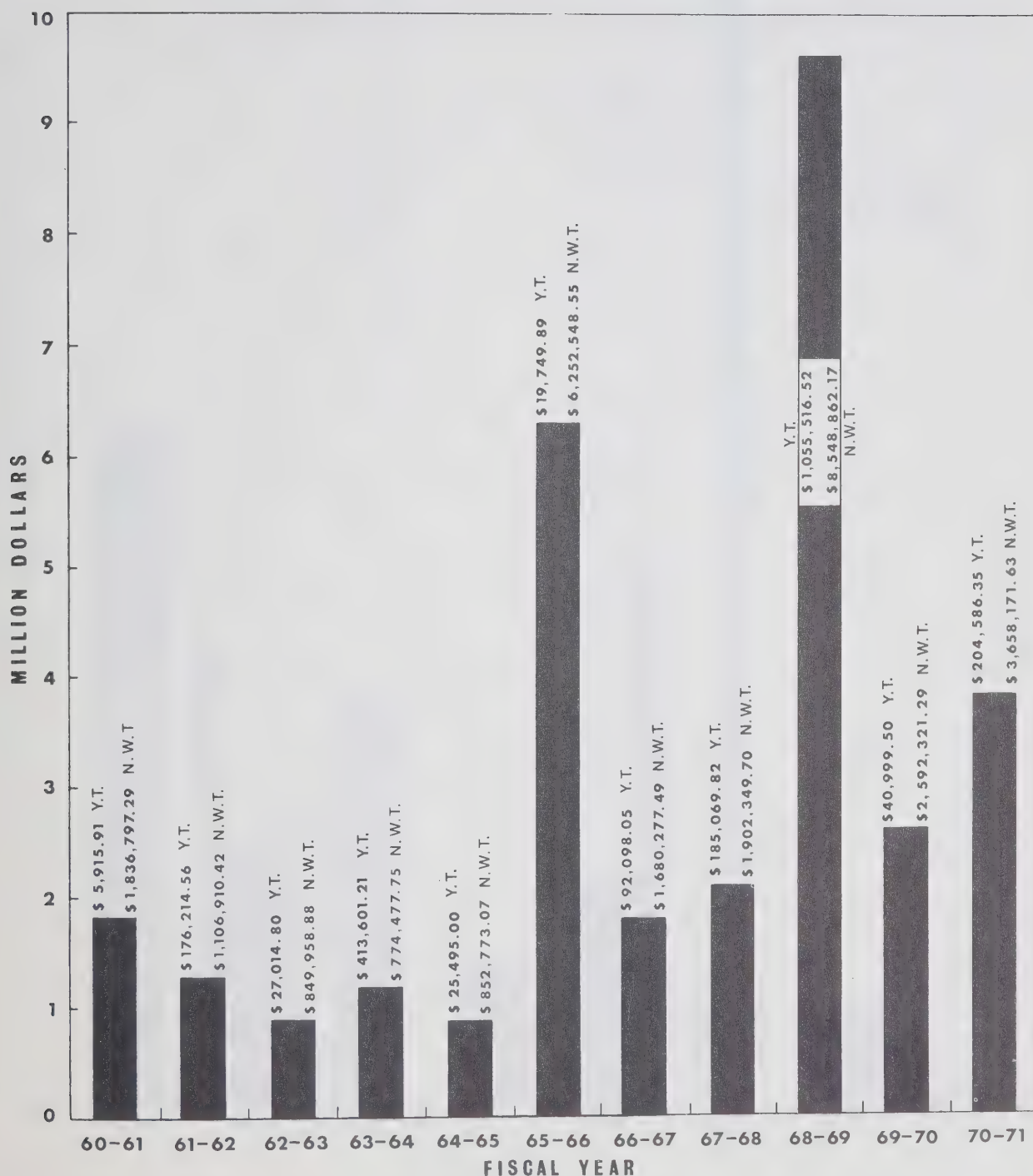


Fig. 12

YUKON TERRITORY - NORTHWEST TERRITORIES

GROSS REVENUE-OIL & GAS

FROM

CASH BONUS BIDS, FEES, FORFEITURES
ROYALTIES, RENTALS & SALE OF MAPS

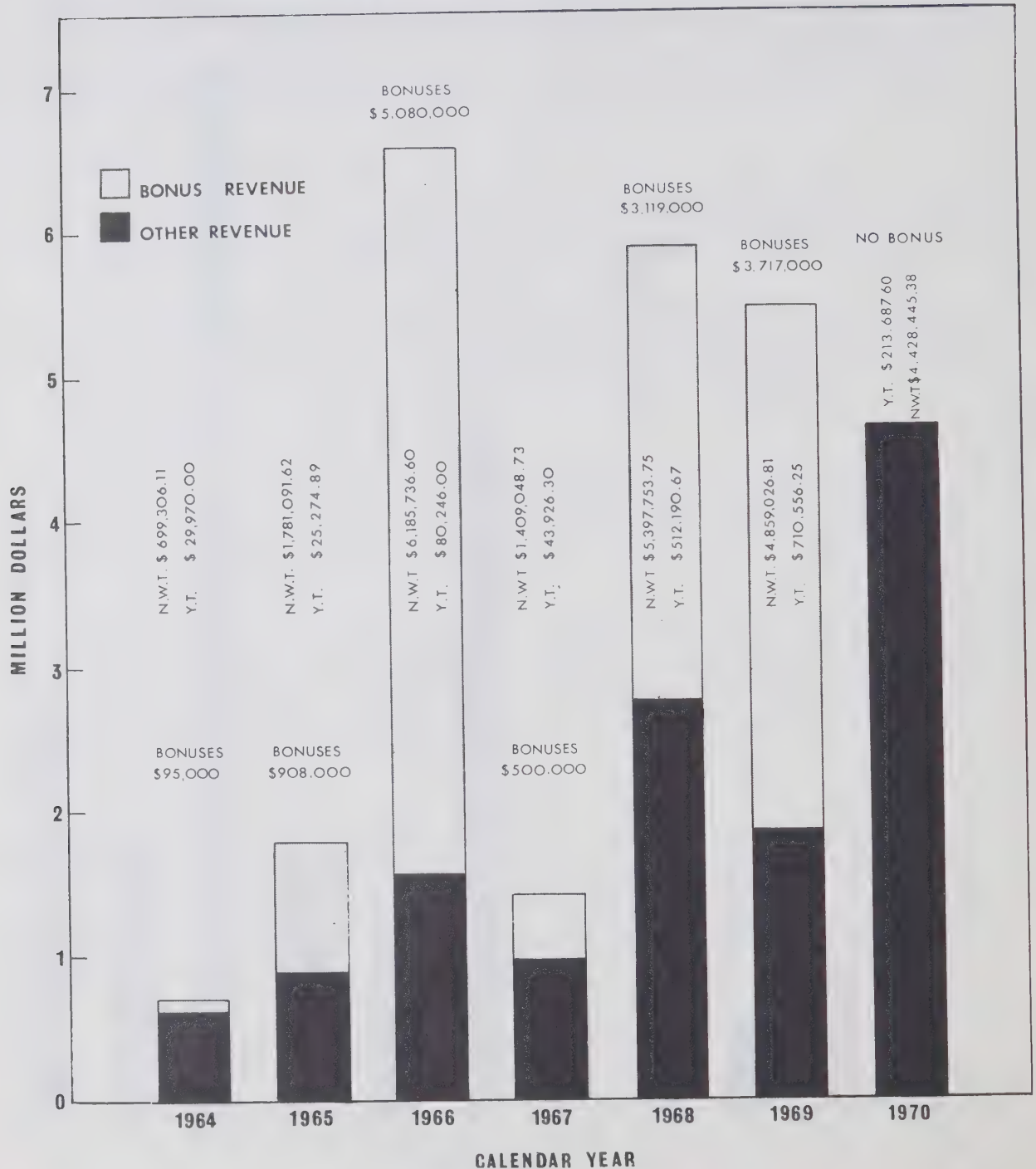


Fig. 13

VALUE OF WORK BONUS TENDERS—OIL & GAS

YUKON TERRITORY AND NORTHWEST TERRITORIES

NOTE: Cumulative Value End of Dec. 1969

\$58,896,608.91

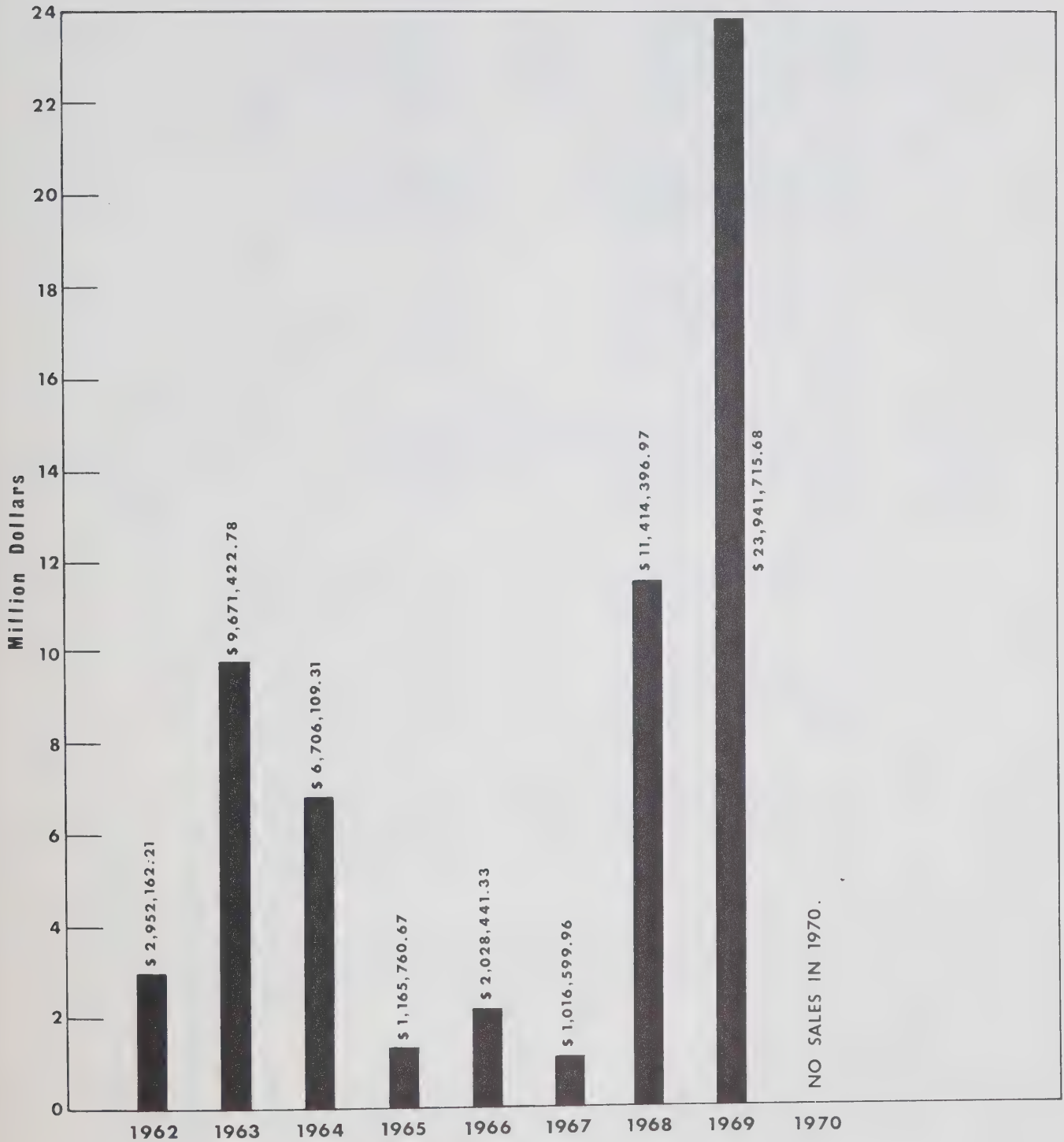


TABLE 4
(By Fiscal Year)

NORTHWEST TERRITORIES

Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	TOTAL
1963-64	1,950.00	183,250.00	7,550.00	40.00	157,519.99	69,882.00	18,288.12	334,395.06	1,023.00	773,898.17
1964-65	1,250.00	551,500.00	7,125.00	30.00	99,977.08	51,258.00	42,822.74	97,911.25	874.00	852,748.07
1965-66	1,425.00	344,000.00	7,850.00	1,050.00	350,130.08	178,878.00	69,952.16	5,298,589.01	674.30	6,252,548.55
1966-67	1,525.00	167,463.15	14,425.00	250.00	500,861.08	213,571.00	94,234.84	687,021.89	925.50	1,680,277.46
1967-68	2,148.18	112,000.00	7,465.00	1,830.00	815,186.24	106,229.00	36,336.07	825,045.35	1,109.86	1,902,349.70
1968-69	2,675.00	932,750.00	49,715.00	1,090.00	1,576,734.76	35,092.00	374,468.96	5,574,369.85	1,966.60	8,548,862.17
1969-70	3,800.00	391,692.70	59,080.00	2,240.00	2,093,730.05	19,630.00	19,852.44		2,296.10	2,592,321.29
1970-71(1)	3,375.00	70,258.60	42,810.00	1,010.00	2,633,134.11(2)	244,072.00	661,828.60		1,683.32	3,658,171.63

YUKON TERRITORY

1963-64	—	23,500.00	—	30.00	6,610.00	—	—	383,461.21	—	413,601.21
1964-65	25.00	12,250.00	—	—	13,220.00	—	—	—	—	25,495.00
1965-66	—	—	—	—	13,220.00	—	6,529.89	—	—	19,749.89
1966-67	—	19,250.00	225.00	—	25,865.00	—	46,758.05	—	—	92,098.05
1967-68	—	9,750.00	—	70.00	11,888.25	—	139,834.86	23,526.71	—	185,069.82
1968-69	—	82,000.00	875.00	330.00	27,939.25	—	7,845.90	936,526.37	—	1,055,516.52
1969-70	—	10,250.00	—	—	30,749.50	—	—	—	—	40,999.50
1970-71(1)	—	—	—	50.00	175,186.75	—	29,349.60	—	—	204,586.35

GRAND TOTAL REVENUES

1963-64	1,187,499.38	1965-66	6,272,298.44	1967-68	2,087,419.52	1969-70	2,633,320.79
1964-65	878,243.07	1966-67	1,772,375.51	1968-69	9,604,378.69	1970-71	3,862,757.98

Fiscal year 1970-71 (9 months actual)

(1) ESTIMATED

(2) PERMIT Renewals — Special Renewals

TABLE 5
(By Calendar Year)

NORTHWEST TERRITORIES

Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	TOTAL
1963	1,600.00	155,000.00	8,200.00	140.00	157,396.56	69,882.00	39,343.52	334,395.06	633.33	766,590.47
1964	1,275.00	459,500.00	5,750.00	—	83,603.58	51,258.00	1,944.05	95,306.73	398.75	699,036.11
1965	1,425.00	323,000.00	7,275.00	890.00	280,449.08	178,178.00	78,826.31	909,353.25	995.00	1,780,391.64
1966	1,425.00	310,463.15	13,150.00	420.00	475,513.08	213,571.00	90,410.40	5,079,885.17	878.80	6,185,716.60
1967	2,175.05	96,250.00	9,475.00	760.00	682,500.74	106,229.00	36,106.20	484,623.02	929.72	1,419,048.73
1968	2,298.18	652,800.00	32,780.00	1,830.00	1,405,916.76	35,092.00	394,254.08	2,871,080.66	1,702.07	5,397,753.75
1969	2,000.00	320,701.30	45,540.00	1,290.00	1,404,600.82	19,630.00	19,852.44	3,043,711.52	1,700.73	4,859,026.81
1970	5,175.00	141,250.00	56,350.00	1,960.00	3,315,524.09(2)	244,072.00	661,828.60	Nil	2,285.69	4,428,445.38

YUKON TERRITORY

1963	—	13,500.00	—	30.00	6,610.00	—	—	383,461.21	—	403,601.21
1964	—	16,750.00	—	—	13,220.00	—	—	—	—	29,970.00
1965	25.00	5,500.00	—	—	13,220.00	—	6,529.89	—	—	25,274.89
1966	—	13,000.00	225.00	225.00	25,865.00	—	41,156.00	—	—	80,246.00
1967	—	9,750.00	—	70.00	11,888.25	—	5,602.05	16,616.00	—	43,926.30
1968	—	86,750.00	875.00	330.00	27,939.25	—	147,680.76	248,615.66	—	512,190.67
1969	—	8,500.00	—	—	30,749.50	—	—	671,306.75	—	710,556.25
1970	—	1,750.00	—	140.00	182,448.00	—	29,349.60	—	—	213,687.60

GRAND TOTAL REVENUES

1963	—	1,170,191.68	1965	—	1,805,666.53	1967	—	1,462,975.03	1969	—	5,569,583.06
1964	—	729,006.11	1966	—	6,265,962.60	1968	—	5,909,944.42	1970	—	4,642,132.98

(1) ESTIMATED

(2) PERMIT Rentals — Special Renewals (\$1,208,794.00)

APPENDICIES

Information, and Names and addresses of agencies with Federal responsibilities for Northern resources, list of publications, instructions for exploration is compiled and collated in the following appendices:

Appendix I — Publications and Sources of Information.

Information and Procedures concerning operation on Canada Lands.

Appendix II — Oil and Gas Well Discoveries.

Appendix III — Wells Completed or Abandoned in 1970 and Maps showing location.

Appendix IV — Reporting Forms for Oil and Gas.

Appendix V — Selected Geologic References.

APPENDIX I

PUBLICATIONS

A. Maps

Many maps dealing with the northern resource activities are published by the Division and are available from the Oil and Gas Land and Exploration Section, Calgary, Alberta, or from the Chief, Oil and Mineral Division, Ottawa. The Oil and Mineral Division publishes a list of maps which may be obtained from either of the above sources.

B. The following reports may be obtained from the Queen's Printer or the Oil and Gas Land and Exploration Section, Calgary; Pre-payment is required

Schedule of Wells 1920-1960	—\$3.00
Schedule of Wells 1920-1961	— 4.00
Schedule of Wells 1920-1963	— 4.00
Schedule of Wells 1962-1964	— 2.00
Schedule of Wells 1965	— 3.00
Schedule of Wells 1966	— 3.00
Schedule of Wells 1967	— 2.50
Schedule of Wells 1968	— 2.50
Schedule of Wells 1969	— 2.50
Schedule of Wells 1970	— in press
Oil and Gas Statistical Report No. 1 (1920-1960)	— 2.50
Oil and Gas Statistical Report No. 2 (1961-1970)	— in preparation
"Technical Reports Available for Inspection 1971". (Geological and Geophysical Reports released from confidential status are available for public inspection only in the office of the Oil and Gas Land and Exploration Section of this Department in Calgary).	— No charge

OTHER SOURCES OF INFORMATION

Information on northern resources activities can be obtained from the Chief, Oil and Mineral Division, Department of IAND, 400 Laurier Ave. West, Ottawa. All cores and samples from wells drilled on Canada lands are stored at the Institute of Petroleum and Sedimentary Geology, 3303-33rd St. N.W., Calgary 44, Alberta. Specialized and technical literature pertaining to Northern Canada can be purchased or persued at the following government agencies:

- (a) Northern Co-ordination Division Library, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa, Ontario.

(b) Department of Energy, Mines and Resources

1. Geological Survey of Canada — Ottawa, Ontario and Vancouver, B.C.

Institute of Petroleum and Sedimentary Geology — Calgary, Alberta.

2. Marine Sciences Branch, Bedford Oceanographic Institute — Dartmouth, N.S.

3. Surveys and Mapping Branch — Ottawa, Ontario.

(c) Defence Research Board, Scientific Information Service

(d) Ministry of Transport

1. Marine Works Branch — Ottawa, Ontario.

2. Marine Operations Branch — Ottawa, Ontario.

3. Telecommunications and Electronics Branch — Edmonton, Alberta and Ottawa, Ontario.

4. Civil Aviation Branch — Winnipeg, Manitoba.

(e) Arctic Institute of North America — Montreal, Quebec.

(f) National Research Council — Ottawa, Ontario.

1. Dominion Observatories Branch — Ottawa, Ontario.

(g) The following brochures published by this Department may be available in some Public Libraries:

i Guide to Northern Non-Renewable Resources

ii Communication and Transportation Facilities Queen Elizabeth Group — Arctic Islands

iii Resource Management Division — Responsibilities and Administration

iv Oil and Gas Canada Lands — Volume No. 2

v Oil and Gas Canada Lands — Edition No. 3

vi Oil and Gas in the Yukon and Northwest Territories — Edition No. 4 — 1967

vii Oil and Gas — North of 60 — 1968

viii Oil and Gas — North of 60 — 1969

ix Prospectus — North of 60

INFORMATION AND PROCEDURES CONCERNING OPERATIONS ON CANADA LANDS

Certain federal agencies are concerned with exploration on Canada lands and must be

notified prior to the commencement of any exploration activity. The operator or permittee – not the contractor, is responsible for providing the requisite advance notice of planned programs to these agencies by writing directly to them.

For offshore programs the agencies that must be informed with respect to each program, in addition to the Oil and Mineral Division, are: the appropriate Maritime Commander in the Department of National Defence, the Aids to Navigation Division of the Ministry of Transport; and, in the case of seismic programs, the appropriate Regional Director of the Department of Fisheries and Forestry. In the case of the Hudson Bay region, operators must also inform the National Research Council of proposed operations. Circumstances may be such that other agencies should be notified as well, and these are listed on the following pages, together with the names of persons who can be of assistance. For example, since operators are responsible for any damage they may cause to underwater commercial cables, it is recommended that they contact the Canadian Hydrographic Service for cable-lay data covering the area over which the work is to be performed. Similarly, Customs and Excise should be contacted by the importing company if vessels or equipment are to be brought in from abroad.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

1. Pursuant to Section 52, "Notices of Commencement of Exploratory Work" must be filed 15 days prior to commencement of proposed programs on the Mainland and Arctic Islands, and 45 days prior to commencement of exploratory work on offshore areas with the,

District Oil Conservation Engineer
Oil and Mineral Division,
112 – 11th Avenue S.E.,
Calgary 21, Alberta.

Phone: 403-264-0201

2. Information and assistance may be obtained from:

Chief,
Oil and Mineral Division,
Northern Economic Development Branch,
Department of Indian Affairs and Northern Development,
400 Laurier Avenue West,
Ottawa, Ontario.

Name: Dr. H.W. Woodward,
Phone: 613-992-0223

3. Advice on operational matters may be obtained from:

Operations Geologist,
Oil and Mineral Division,
Northern Economic Development Branch,
Ottawa, Ontario.

Name: S.A. Kanik
Phone: 613-992-0921

4. Information and advice on the Land Use Regulations may be obtained from:

Head,
Water and Land Use Management,
Water, Forests and Land Division,
400 Laurier Avenue West,
Ottawa, Ontario.

Name: G.B. Armstrong
Phone: 613-996-2998

DEPARTMENT OF FISHERIES AND FORESTRY

Resource Development Branch

Advance notice of 90 days is required before the start of a marine seismic survey involving the use of high explosives, in the event that qualified observers are needed. Nominal advance notice is required before the start of a seismic survey in which a source of accoustical energy other than high explosives is to be used. This Department must also be informed of any offshore drilling program prior to its commencement.

Written notices should be sent to the appropriate Regional Director of Fisheries with a copy to:

Director,
Environmental Quality,
Department of Fisheries and Forestry,
Sir Charles Tupper Building,
Ottawa, Ontario.

Name: K.C. Lucas
Phone: 613-997-8041

Information regarding the Department's requirement can also be obtained from:

Deputy Director,
Resource Development Service.

Name: E.W. Burridge
Phone: 613-997-4526

The address of the Regional Director responsible for all fresh water lakes in the Northwest Territories is:

C. McEwan,
114 Gary Street,
Winnipeg 1, Manitoba.

Phone: 204-946-8101

For all fresh water lakes in the Yukon Territory is:

W.R. Hourston,
1155 Robson Street,
Vancouver 5, B.C.

Phone: 604-666-1671

Information concerning wildlife such as the locations of migratory bird sanctuaries and National Wildlife Areas may be obtained from:

Director,
Canadian Wildlife Service,
Department of The Environment,
400 Laurier Avenue West,
Ottawa, Ontario.

Attention: N.G. Perret
Phone: 613-992-5305

CANADIAN METEOROLOGICAL SERVICE

Requests for information and assistance on meteorological and sea-ice data, climatology, weather forecasting, meteorological instruments and research may be directed to:

Administrator,
Canadian Meteorological Service,
Ministry of Transport,
315 Bloor Street West,
Toronto 181, Ontario.

Name: J.R.H. Noble
Phone: 416-966-6539

Information may also be obtained through the Meteorological Liaison Officer in Ottawa. This position is filled on a rotation basis and the name of the officer is subject to change. Inquiries in Ottawa may be directed to:

Meteorological Liaison Officer,
Ministry of Transport,
No. 3 Temporary Building,
Ottawa, Ontario.

Name: D.J. Wright
Phone: 613-992-4217

DEPARTMENT OF NATIONAL DEFENCE

Maritime Commanders

The appropriate Office of Maritime Command requires 45 days advance notice in writing of any exploration program proposed for the offshore. Relevant information will be supplied the operator on a need-to-know basis. Approval must be obtained from the Department before the commencement of work.

Operations in Baffin Bay, and Arctic waters east of longitude 105° West are handled by the office of:

Commander Maritime Command,
Department of National Defence,
F.M.O., HMC Dockyard,
Halifax, Nova Scotia.

Operations in Arctic waters west of longitude 105° West are handled by the office of:

Maritime Commander (Pacific),
Department of National Defence,
F.M.O., HMC Dockyard,
Victoria, B.C.

MINISTRY OF TRANSPORT

Aids to Navigation Division

At least 60 days notice is required by this Division before the commencement of any offshore exploration program, in order that appropriate local Notices to Shipping and national Notices to Mariners may be issued. These Notices are subsequently copied into related foreign publications. The Division also indicates the requirement for any aids to navigation devices that may be necessary for the program.

Advance notice of 90 days is required in any case where a drilling program involves the territorial sea, in order for approval to be granted under the Navigable Waters Protection Act.

All communications on these matters should be directed to:

Chief, Aids to Navigation,
Marine Works Branch,
Ministry of Transport,
Ottawa, Ontario.

Phone: 613-992-2736

In addition, there are a number of Departmental officers who may be contacted in the field should the need arise. Their titles and addresses are given below:

District Marine Agent,
Ministry of Transport,
P.O. Box 310, Uppertown,
Quebec 4, Quebec
(This office handles Hudson Bay)

District Manager,
Ministry of Transport,
P.O. Box 155,
Hay River, N.W.T.

Phone: 403-874-2331

Marine Operations Branch

This agency directs the operations of the Canadian Coast Guard which has major responsibilities in two areas of concern to offshore operations: support of shipping in ice-congested waters, and marine search and rescue.

If operations are being contemplated for areas where ice may be a problem and where ice-breaker or other support may be desired, there should be consultation with the Director of Marine Operations as long in advance as possible. This is particularly important in the case of Arctic and Hudson Bay operations where the planning of ice-breaker disposition is usually done six months in advance of the season.

Further information and assistance may be obtained from:

Director,
Marine Operations Branch,
Ministry of Transport,
Ottawa, Ontario.

Name: A.H.G. Storrs
Phone: 613-992-4209

Marine Regulations Branch

This Branch includes the Steamship Inspection Division and the Nautical and Pilotage Division. The responsibilities of the former Division include inspection and certification of vessels under the Canada Shipping Act, oil pollution by vessels, and safety of life at sea. The responsibilities of the latter Division include registration of shipping, pilotage, marine accident investigation and inquiries, salvage, marine personnel and navigational safety matters. This last includes the establishment of restricted navigation areas and the routing of ships.

Further information and assistance may be obtained from:

Director,
Marine Regulations Branch,
Ministry of Transport,
Ottawa, Ontario.

Name: R.R. Macgillivray
Phone: 613-992-8892

Information with regard to safety of life at sea and acceptable standards of seaworthiness may be referred to:

Chairman,
Board of Steamship Inspection,
Marine Regulations Branch.

Name: W.E. Harrison
Phone: 613-992-1312

DEPARTMENT OF COMMUNICATIONS

Telecommunications Regulation Branch

The responsibilities of this agency include the development of technical standards, the selection and coordination of radio frequencies, and the licensing of all classes of radio stations except broadcasting.

An operator contemplating the use of radio communications in his offshore activities should make application for licensing of any radio station in Canada or on board any Canadian vessel involved at least six weeks before the proposed in-service date of the communication facility. Details as to the licensing requirements and the necessary application forms may be obtained from the Regional Superintendent, Telecommunications Regulation Branch, Department of Communications:

Oil companies in Western Canada may contact:

Radio Superintendent,
Telecommunications Regulations Branch,
Department of Communications,
Federal Building,
Edmonton, Alberta.

Name: L.E. Nelson
Phone: 403-424-0251 (Extension: 334)

If need be, the following persons in Ottawa may be contacted for assistance:

Director,
Telecommunications Regulation Branch,
Department of Communications,
Ottawa, Ontario.

Name: W.J. Wilson
Phone: 613-992-0840

Advice in determining communication requirements and the necessary applications for licence may also be obtained from:

Chief,
Radio Authorization and Enforcement Division,
Department of Communications,
Ottawa, Ontario.

Name: A.G.E. Argue
Phone: 613-992-3427

DEPARTMENT OF ENERGY, MINES AND RESOURCES

Marine Sciences Branch

In addition to providing the commercial-cable lay data, the Canadian Hydrographic Service publishes charts of Canadian coastal waters, and information concerning these may be obtained from:

Canadian Hydrographic Service,
Marine Sciences Branch.

Attention: W.J. Covey
Phone: 613-994-9155

Information concerning charts showing Canada's Territorial Sea and Fishing Zone Limits and related data may be obtained from:

Canadian Hydrographic Service,
Marine Sciences Branch.

Attention: E.J. Cooper
Phone: 613-994-5411

Information on physical oceanography may be obtained from:

Canadian Oceanographic Data Centre,
Marine Sciences Branch.

Attention: C.M. Cross
Phone: 613-992-9104

Information on tides may be obtained from:

Tides and Water Levels,
Marine Sciences Branch.

Attention: G.C. Dohler
Phone: 613-992-9122

Information on hydrographic surveys and control data in the western Arctic regions may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
512 Federal Building,
Victoria, British Columbia.

Name: M. Bolton
Phone: 604-338-3188

Information on hydrographic surveys and control data in the eastern Arctic may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
Atlantic Oceanographic Laboratory,
Bedford Institute,
Dartmouth, Nova Scotia.

Name: R.C. Melanson
Phone: 902-426-3497

Surveys and Mapping Branch

Information on the systems, methods and equipment utilized in positioning and surveying with respect to exploration work may be subject to review by this agency. Moreover, legal surveys must be made in accordance with instructions of the Surveyor General.

Inquiries concerning surveying may be directed to:

Surveyor General,
Legal Surveys Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: R. Thisthelthwaite
Phone: 613-994-9174

Information concerning coastal control surveys may be obtained from:

Geodetic Survey Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: C.E. Hoganson
Phone: 613-994-5079

When requesting control survey data, the enquiries should define the area involved by latitude and longitude. In the case of a large area, it is important to state priorities within the area to facilitate processing.

Resource Management and Conservation Branch

The Resource Management and Conservation Branch is responsible for the administration of the federal interests in the mineral resources off Canada's east and west seacoasts and in the Hudson Bay and Hudson Strait regions.

All correspondence should be addressed to:

Director,
Resource Management and Conservation Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: D.G. Crosby
Phone: 613-994-5065

Surveys and Mapping Branch

Air photographs covering all portions of Canada may be obtained from:

National Air Photo Library,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: G.H. Whitcher
Phone: 613-994-5433

Topographic maps, indices charts, atlases and numerous other map publications may be obtained from:

Map Distribution Office,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: G.A. Clemmer
Phone: 613-994-9663

Geological Survey of Canada

The Geological Survey of Canada carries out systematic geological and geophysical surveys in the sedimentary basins of Canada, including parts of the regions offshore from the east and west coasts, in Hudson Bay, and in the Arctic Islands.

Inquiries with regard to the operations and publications of the Geological Survey should be made to:

Director,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: Y.O. Fortier
Phone: 613-994-5817

or to:

Director,
Institute of Sedimentary and Petroleum Geology,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Calgary 44, Alberta.

Name: D.J. McLaren
Phone: 403-284-0110

Polar Continental Shelf Project

The Polar Continental Shelf Project is a continuing investigation of the continental shelf fringing the Arctic coast of Canada, together with adjacent parts of the Arctic Ocean basin, the islands of the Canadian Arctic Archipelago and the waters between them, and other areas of special interest.

Inquiries regarding surveys and scientific studies in Arctic areas may be directed to:

Co-ordinator,
Polar Continental Shelf Project,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: E.F. Roots
Phone: 613-996-3388

NATIONAL RESEARCH COUNCIL

Space Research Facilities Branch

Operators planning offshore activities in the Hudson Bay region must inform the following agency of the National Research Council well in advance since rockets are fired on a year round basis from the Churchill Research Range:

Head,
Range Section,
Space Research Facilities Branch,
National Research Council,
Ottawa 7, Ontario.

Name: Z.R. Charko
Phone: 613-993-9385

Operators active in the Hudson Bay region are also required to co-ordinate their field activities with:

General Superintendent,
Churchill Research Range,
National Research Council,
Fort Churchill, Manitoba.

Name: T.W. McGrath
Phone: 204-856-3010

Rockets are also launched from time to time from the facilities at Resolute Bay, N.W.T. and operators with exploration work planned for this vicinity are urged to co-ordinate their activities with the National Research Council.

DEPARTMENT OF NATIONAL REVENUE

Customs and Excise

The Port Administration Division administers that portion of the Canada Shipping Act that relates to the coasting trade. In this connection, any company importing ships or specialized plant and equipment for exploration work on Canada's seacoasts may obtain information, assistance and such other contacts as may be necessary in Customs and Excise from:

Director,
Port Administration Division,
Customs and Excise,
Department of National Revenue,
Ottawa, Ontario.

Name: M.A. Gallup
Phone: 613-992-4952

DEPARTMENT OF MANPOWER AND IMMIGRATION

Canada Immigration Division

Inquiries should be directed to:

Department of Manpower and Immigration,
Home Services Branch,
Canada Immigration Division,
Admission Section,
Ottawa, Ontario.

Attention: Mr. G.E. White
Phone: 613-992-3305

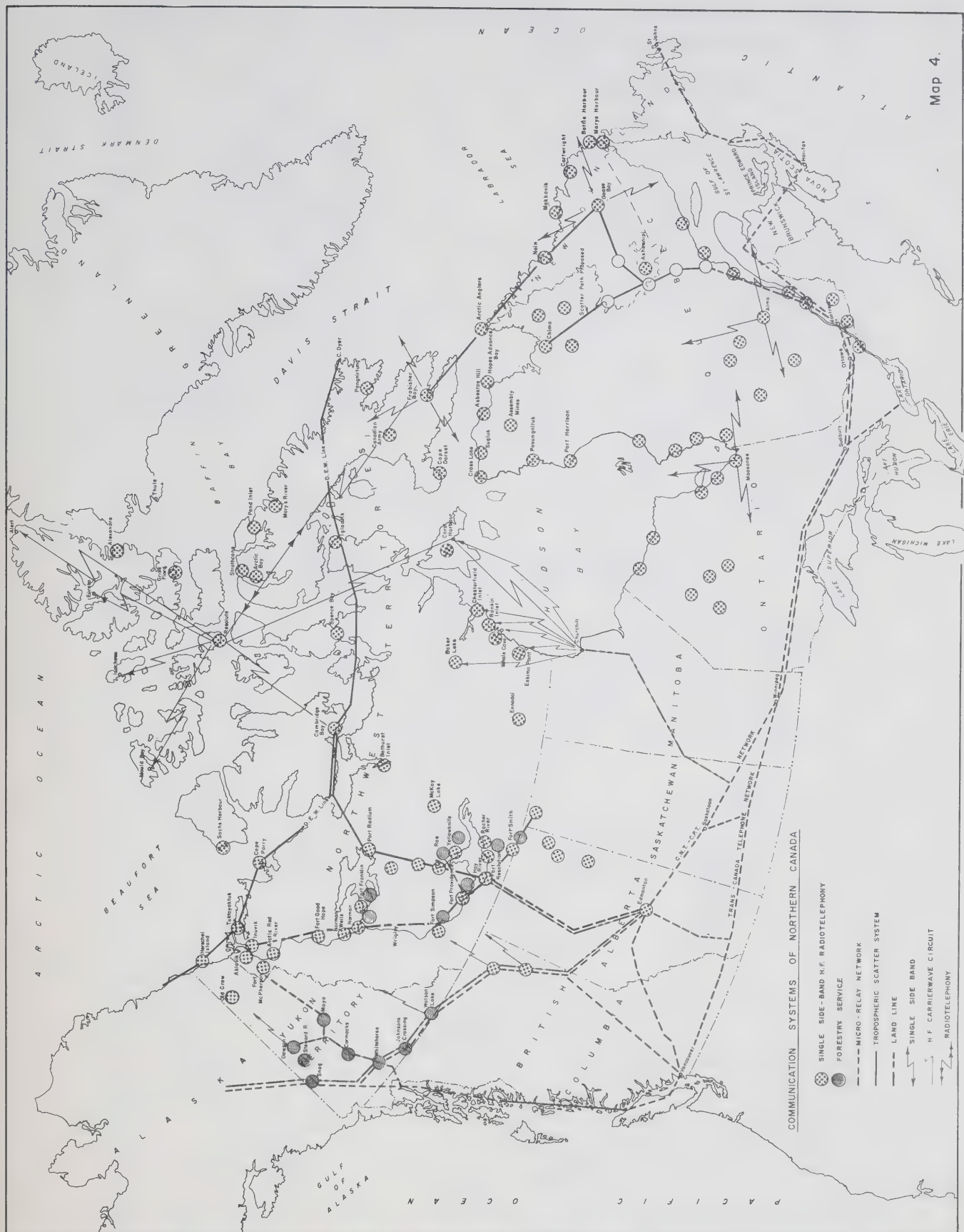
The Calgary and Edmonton offices of the Department of Manpower and Immigration can answer any queries regarding entry into the Northwest Territories. The Vancouver office can respond to queries for entry into the Yukon Territory.

At Tuktoyaktuk, a local R.C.M.P. officer is also a representative of the Department of Manpower and Immigration and can clear entry into Canada via Tuk.

At Inuvik, the Customs Department is also Departmental representative for Manpower and Immigration and can be contacted by telephone if prior arrangements are necessary. There is no representative at Aklavik; in the event that a seismic crew prefers to land at Aklavik, arrangements must be made with the Inuvik representative.

COMMUNICATIONS






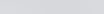
Information in the brochure, "Communications and Transportation Facilities, Queen Elizabeth Group, Arctic Islands", is being updated and will be available in a comprehensive report entitled "Operational Guide for Oil and Gas Companies in the North". This publication is now in preparation and should be available by December, 1971. In addition to information concerning communication and transportation, the report will contain information covering all aspects of exploration in the North.



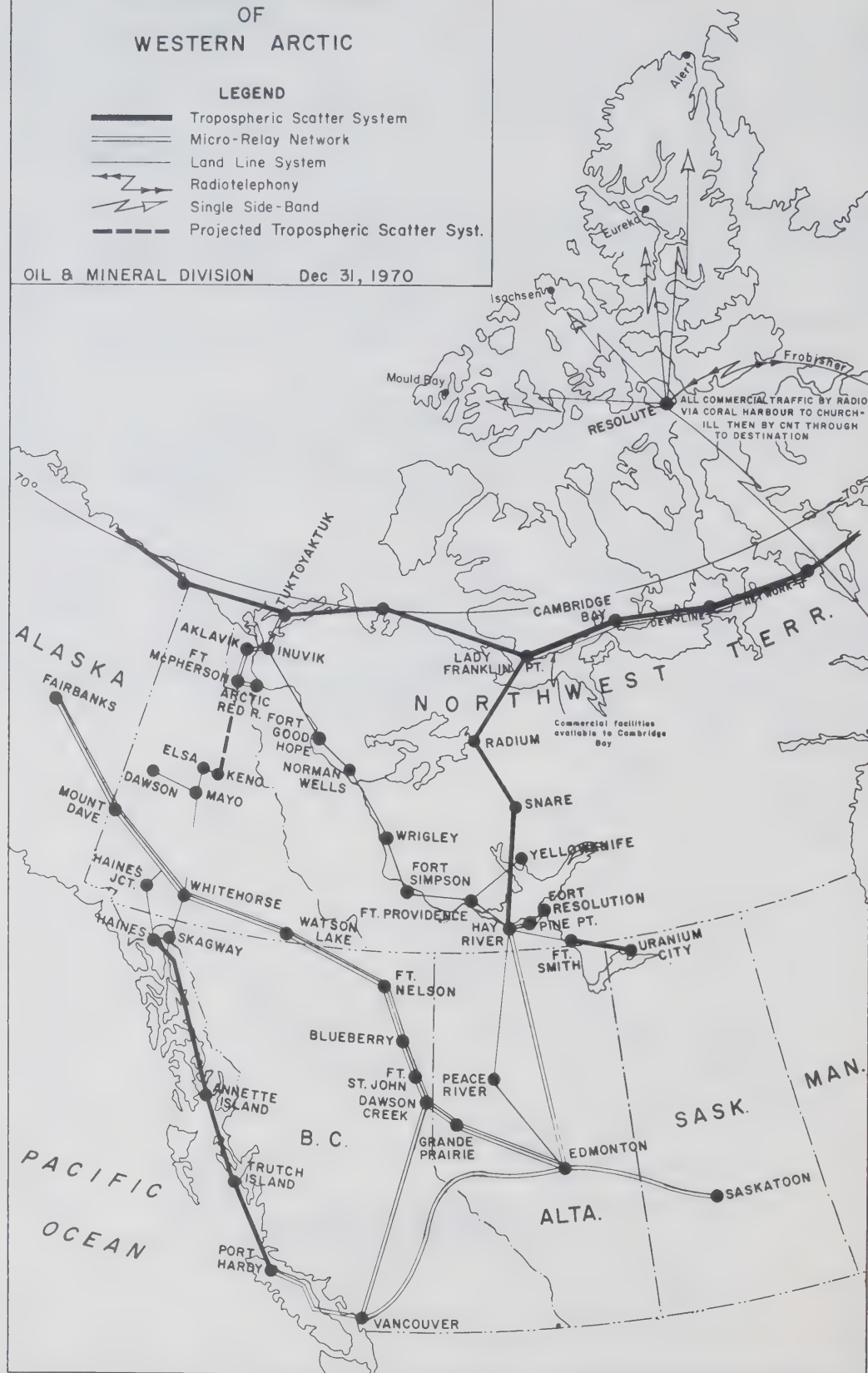
Map 4.

COMMUNICATION SYSTEMS OF WESTERN ARCTIC

LEGEND

-  Tropospheric Scatter System
-  Micro-Relay Network
-  Land Line System
-  Radiotelephony
-  Single Side-Band
-  Projected Tropospheric Scatter Syst.






OIL & MINERAL DIVISION Dec 31, 1970



QUEEN ELIZABETH ISLANDS

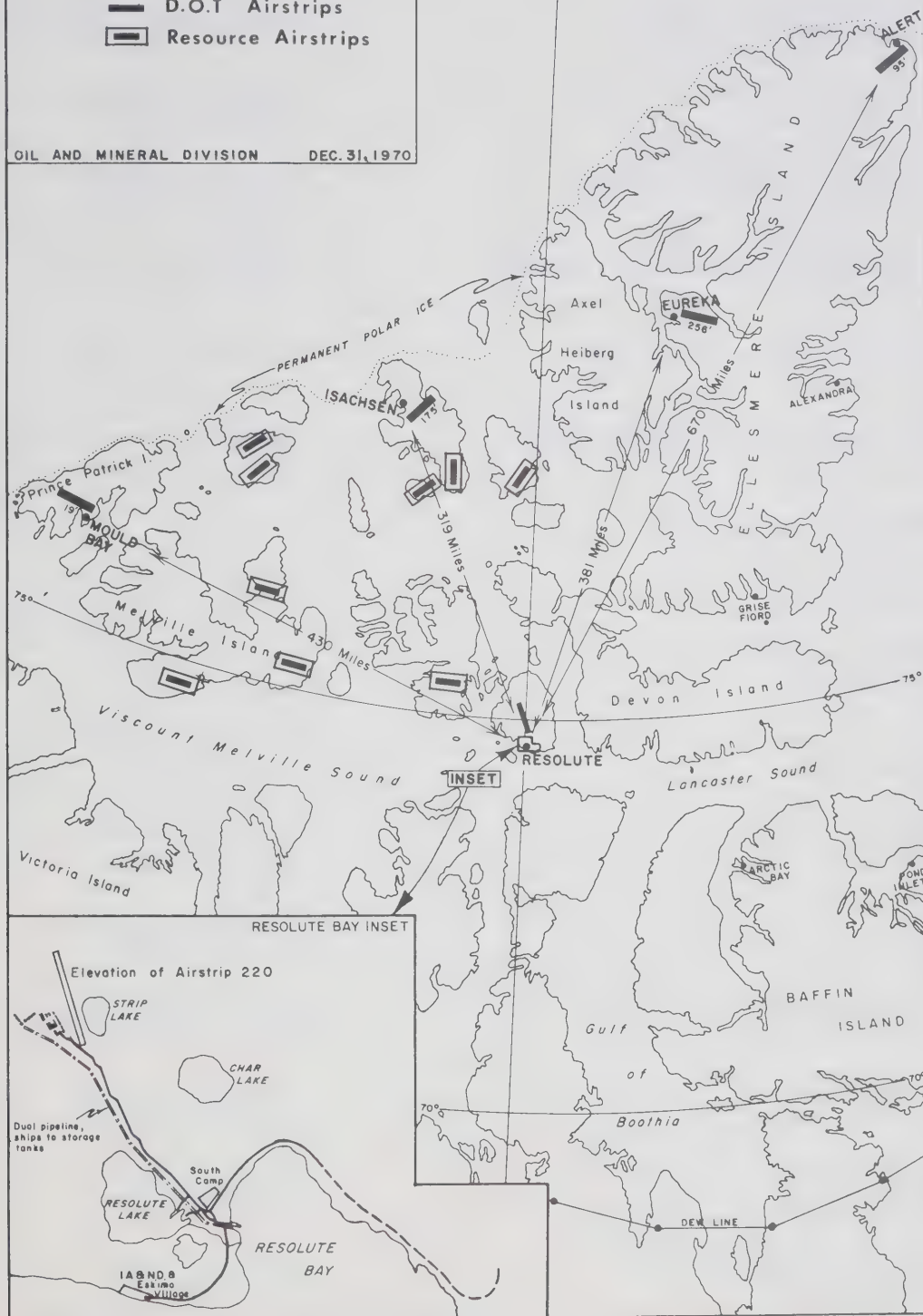
SCALE
100 50 0 100

LEGEND

-  Direction of Airstrip
-  Elevation of Airstrip
-  Air Miles
-  D.O.T Airstrips
-  Resource Airstrips

OIL AND MINERAL DIVISION DEC. 31, 1970

Map 6



APPENDIX II

OIL AND GAS WELL DISCOVERIES

YUKON TERRITORY

Canada Southern et al N. Beaver R. Y.T. I-27 I-27-60-10-124-00	Suspended gas well September 29, 1964
Canoe River Change Y.T. J-19 J-19-66-10-137-30	Suspended gas well February 17, 1968
Pan Am Beaver Y.T. G-01 G-01-60-10-124-15	Shut-in Gas well August 13, 1969
Socony Mobil et al Chance Y.T. G-08 G-08-66-10-137-30	Suspended oil well March 31, 1965
Socony Mobil et al Blackie No. 1 Y.T. M-59 M-59-66-00-137-00	Suspended gas well March 27, 1964
Socony Mobil et al Birch, Y.T. B-34 B-34-66-10-136-45	Suspended gas well June 8, 1965
Western Minerals Chance Y.T. No. 1 M-08 M-08-66-10-137-30	Suspended oil and gas well January 31, 1960

NORTHWEST TERRITORIES

Briggs Rabbit Lake No. 3 B-07 B-07-61-00-118-45	Suspended gas well March 9, 1957
Briggs Rabbit Lake No. 1 O-16 O-16-61-00-118-45	Suspended gas well March 17, 1955
CPOG et al LaBiche F-08 F-08-60-40-124-30	Suspended gas well March 27, 1970
HB Cameron Hills A-05 A-05-60-10-117-30	Suspended gas well April 16, 1968
HB Pan Am S. Island R. M-41 M-41-60-10-121-00	Suspended gas well March 23, 1964
Home Signal Celibeta H-78 H-78-60-10-122-00	Suspended gas well March 13, 1960
IOE Atkinson H-25 H-25-69-50-131-45	Suspended oil well February 23, 1970
Pan Am Pointed Mountain P-53 P-53-60-30-123-45	Shut-in gas well March 10, 1967
Pan Am Pointed Mountain K-45 K-45-60-30-123-45	Shut-in gas well May 8, 1968

Pan Am Pointed Mountain G-62
G-62-60-30-123-45

Shut-in gas well
June 20, 1969

Sun Nelta C-07
C-07-60-50-122-45

Suspended gas well
April 5, 1961

Texaco Bovie Lake J-72
J-72-60-20-122-45

Suspended gas well
April 20, 1966

Union Pan Am Trainor Lake C-3
C-39-60-20-120-30

Suspended gas well
March 15, 1965

ARCTIC ISLANDS

Panarctic Drake Point L-67
L-67-76-30-108-30

Suspended gas well
February 26, 1970

Panarctic King Christian D-18-A
D-18-77-50-101-00

Suspended gas well
March 15, 1971

APPENDIX III

WELLS COMPLETED OR ABANDONED IN 1970

NORTHWEST TERRITORIES

NAME OF WELL	SPUDDED	COMPLETED	STATUS	TOTAL DEPTH
AmHess Gulf Redknife E-55	12-1-70	4-2-70	D & A	4,087'
Amoco Murphy Cormack N-33	1-2-70	14-3-70	D & A	6,258'
Amoco et al Poplar River I-32	5-2-70	13-3-70	D & A	4,988'
Atkinson et al Island River J-44	23-1-70	25-2-70	D & A	7,083'
Banner et al Little Growl N-11	3-3-70	5-4-70	D & A	7,438'
Banff et al Oscar Creek H-71	22-8-70	5-9-70	D & A	1,416'
Banff et al Oscar Creek J-48	13-9-70	22-9-70	D & A	1,510'
Banff et al Rat Pass K-35	21-10-70	13-12-70	D & A	6,004'
Canada Southern Celibeta N-39	15-3-70	20-3-70	D & A	1,003'
Canso et al Grumbler J-13	23-2-70	12-3-70	D & A	2,854'
CPOG Chevron Gull Creek A-63	14-2-70	28-2-70	D & A	3,095'
CPOG Chevron Kakisa G-31	4-3-70	19-3-70	D & A	3,710'
CPOG Chevron Tathlina K-24	23-3-70	6-4-70	D & A	3,451'
Cdn-Sup et al Jean Marie E-07	31-12-69	18-1-70	D & A	3,153'
Cdn-Sup et al Jean Marie J-52	23-1-70	6-2-70	D & A	2,200'
CDR et al Mills Lake N-74	3-2-70	9-2-70	D & A	1,810'

NAME OF WELL	SPUDDED	COMPLETED	STATUS	TOTAL DEPTH
CS Noel Laferte River N-15	25-2-70	3-3-70	D & A	1,672'
CS Noel Laferte River J-03	4-3-70	12-3-70	D & A	1,568'
Elf Cape Norem A-80	20-4-70	27-8-70	D & A	9,744'
Elf Horton River G-02	9-11-69	22-1-70	D & A	8,130'
Gobles et al Celibeta D-66	30-1-70	18-3-70	D & A	8,552'
GPD Noel et al Mills West M-65	24-3-70	31-3-70	D & A	1,548'
GPD Noel et al Mills West M-65A	31-3-70	8-4-70	D & A	1,848'
Gulf East Reindeer C-38	4-5-70	25-6-70	D & A	8,506'
Gulf East Reindeer P-60	17-3-70	23-4-70	D & A	6,300'
Gulf et al Trout River D-14	15-2-70	2-3-70	D & A	2,259'
Gulf et al Redknife H-28	21-1-70	6-2-70	D & A	2,330'
HB Shell W Cameron F-24	24-1-70	21-2-70	D & A	6,234'
HB Petitot C-60	16-2-70	21-3-70	D & A	7,315'
HB Great Plains Simpson D-25	25-2-70	11-3-70	D & A	3,432'
Husky et al Willowlake H-10	27-2-70	27-3-70	D & A	3,270'
Husky et al Sibbeston G-69	3-1-70	28-1-70	D & A	3,570'
Husky et al Willowlake O-27A	29-1-70	22-2-70	D & A	2,920'
Husky HB et al Willowlake G-32	14-3-70	5-4-70	D & A	2,745'

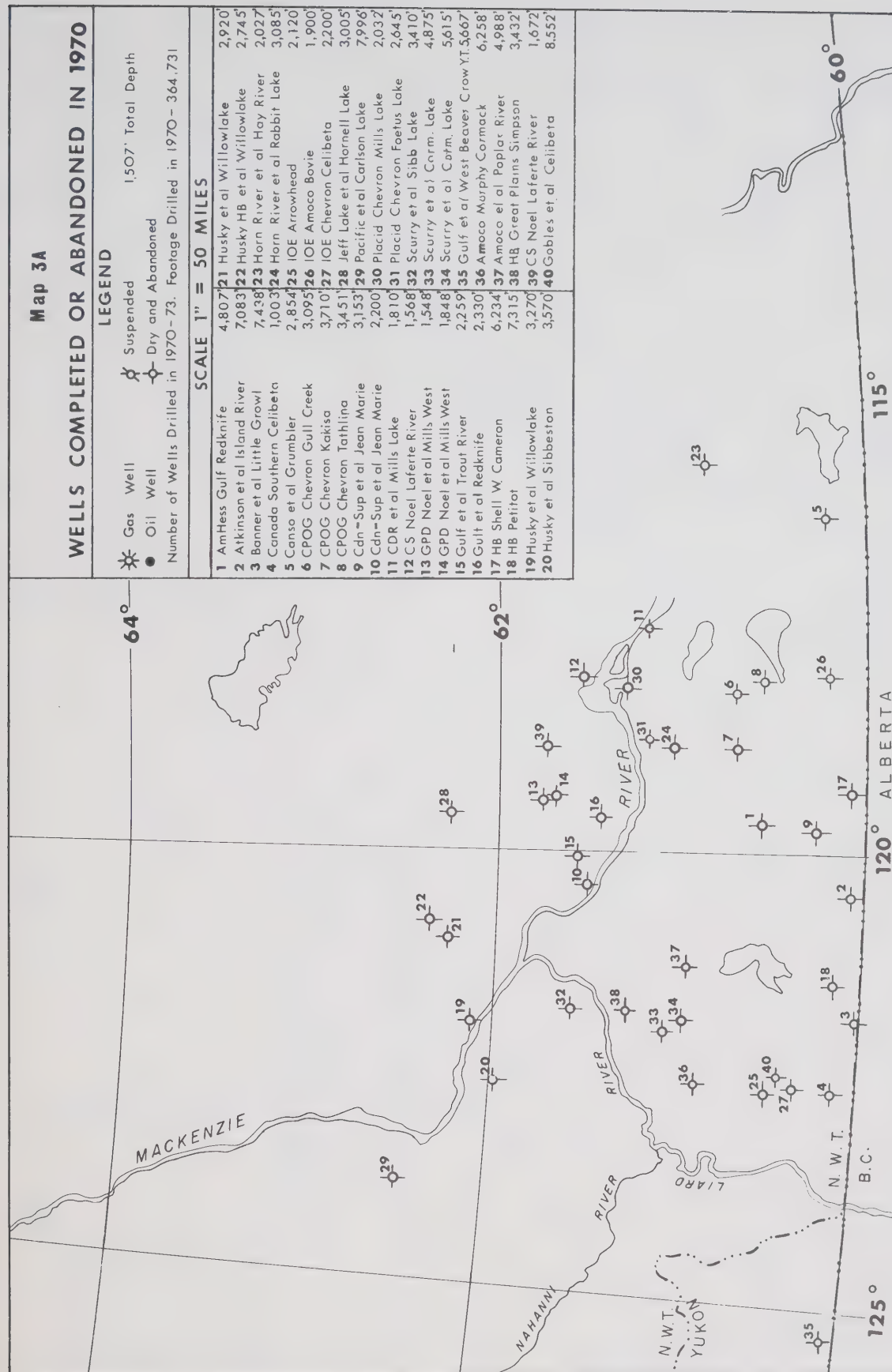
NAME OF WELL	SPUDDED	COMPLETED	STATUS	TOTAL DEPTH
Horn River et al Hay River B-52	8-12-70	22-12-70	D & A	2,027'
Horn River et al Rabbit Lake H-01	11-12-70	22-12-70	D & A	3,085'
IOE Arrowhead L-49	26-1-70	5-2-70	D & A	2,120'
IOE Atkinson H-25	14-12-69	26-2-70	Oil Well	5,941'
IOE Atkinson M-33	1-5-70	3-6-70	D & A	6,327'
IOE Amoco Bovie M-05	6-1-70	18-1-70	D & A	1,900'
IOE Chevron Celibeta D-31	8-2-70	19-2-70	D & A	2,200'
IOE Ellice O-14	19-11-69	17-2-70	D & A	9,531'
IOE Natagnak K-23	13-3-70	13-4-70	Tempera- ture Observa- tion Well	4,977'
IOE Natagnak H-50	30-4-70	1-6-70	D & A	6,402'
IOE Nuvorak 0-09	12-3-70	14-4-70	D & A	3,798'
Jeff Lake et al Hornell Lake F-17	5-2-70	7-3-70	D & A	3,005'
McD et al Maida CK F-57	10-7-70	12-7-70	D & A	4,863'
McD et al Maida CK G-56	25-8-70	9-9-70	D & A	2,105'
Mobil Colville E-15	18-4-70	18-10-70	D & A	5,996'
Mobil et al Slater River A-37	9-8-70	23-8-70	D & A	3,500'
Mobil et al Ontadek L. N-39	13-4-70	30-5-70	D & A	5,901'
Mobil et al Thunder R. D-69	2-2-70	17-2-70	D & A	1,200'
Pacific et al Carlson Lake A-50	17-1-70	11-3-70	D & A	7,996'

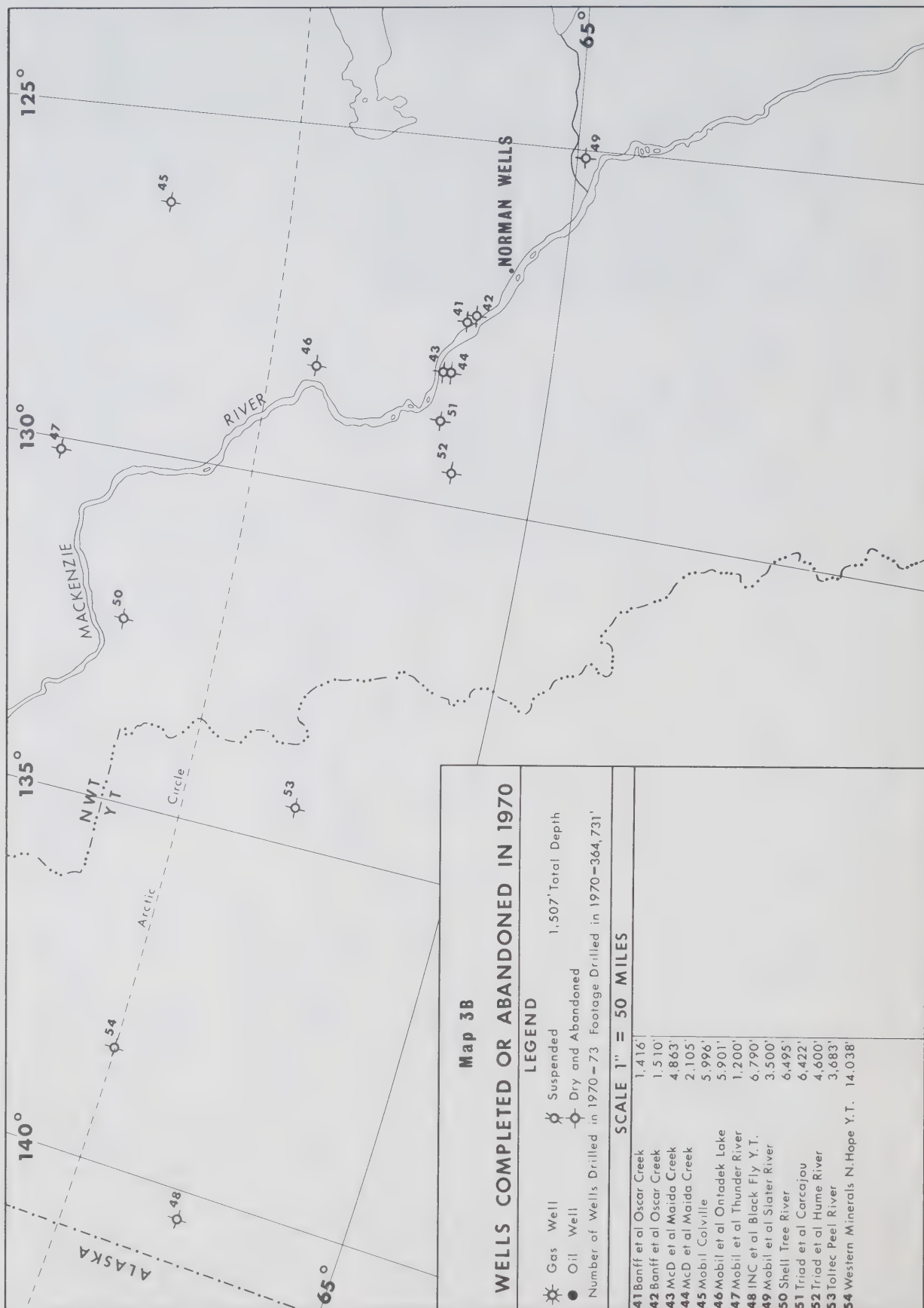
NAME OF WELL	SPUDDED	COMPLETED	STATUS	TOTAL DEPTH
Panarctic Drake Point L-67	22-9-69	26-2-70	Suspend- ed Gas Well	10,671'
Panarctic Drake Point N-67	14-4-69	9-11-70	Sus- pended	8,454'
Panarctic Drake Point K-67	19-7-70	9-11-70	Sus- pended	3,198'
Panarctic Hecla J-60	31-5-70	16-9-70	D & A	11,865'
Panarctic Hoodoo Dome H-37	20-12-69	17-8-70	D & A	11,072'
Panarctic Towson Point F-63	23-3-70	16-6-70	D & A	5,123'
Placid Chevron Mills Lake C-60	26-2-70	5-3-70	D & A	2,032'
Placid Chevron Foetus Lake C-49	9-3-70	20-3-70	D & A	2,645'
Scurry et al Sibb L.-G-24	4-2-70	9-3-70	D & A	3,410'
Scurry et al Corm. L. G-15	16-2-70	20-3-70	D & A	4,875'
Scurry et al Corm. L. I-49	9-1-70	10-2-70	D & A	5,615'
Shell Aklavik A-37	2-8-70	13-10-70	D & A	8,479'
Shell Tree River F-57	10-11-70	12-12-70	D & A	6,495'
Triad et al Carcajou L-24	10-12-69	26-1-70	D & A	6,422'
Triad et al Hume R O-62	9-2-70	15-3-70	D & A	4,600'

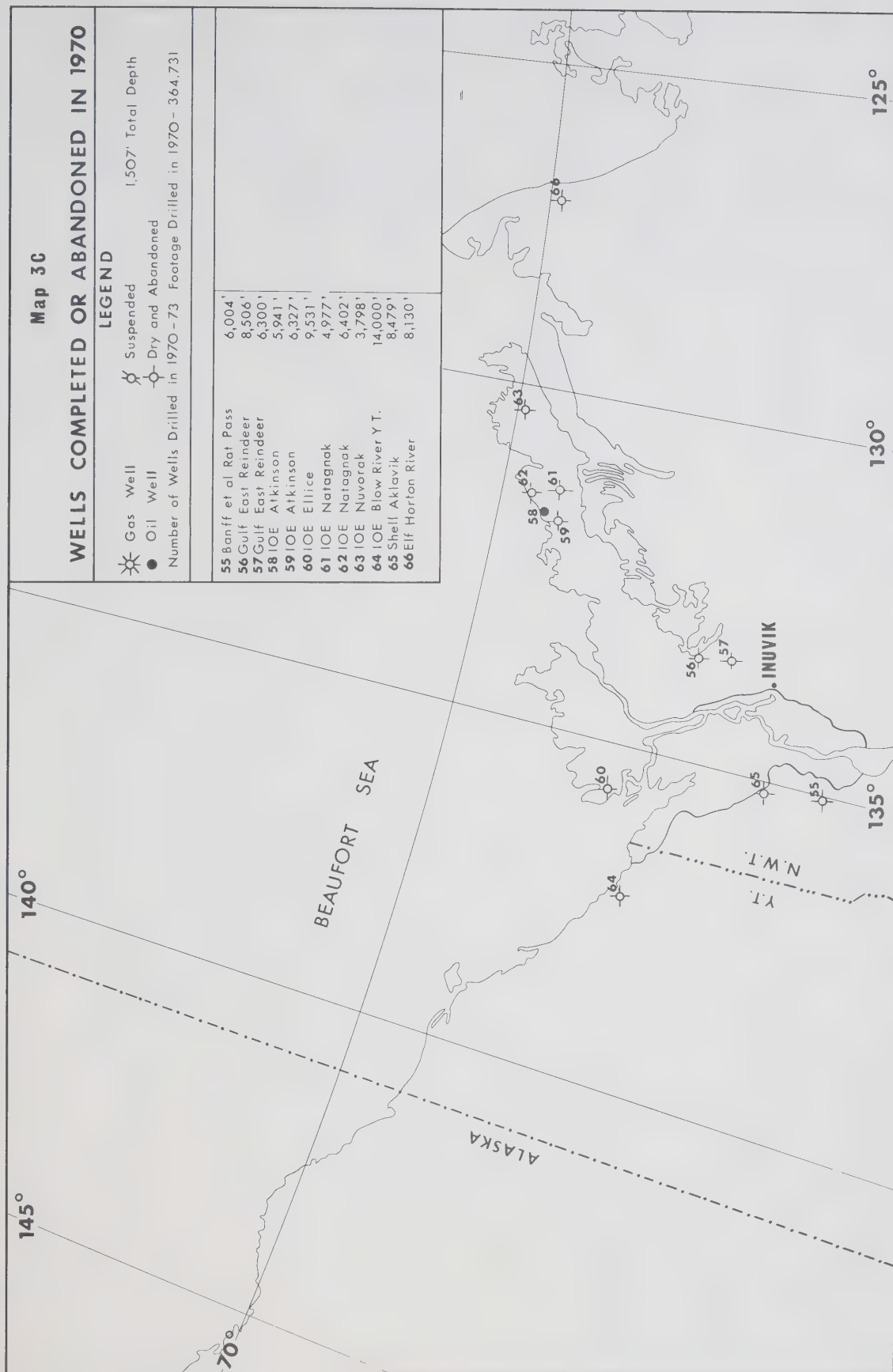
NAME OF WELL	SPUDDED	COMPLETED	STATUS	TOTAL DEPTH
YUKON TERRITORY				
Gulf et al West Beaver Crow Y.T. 0-15	3-2-70	1-6-70	D & A	5,667'
IOE Blow River Y.T. E-47	8-5-70	15-11-70	Tempera- ture Obs- ervation Well	14,000'
INC et al Black Fly Y.T. M-55	13-1-70	1-4-70	D & A	6,790'
Toltec Peel River Y.T. N-77	7-10-68	23-7-70	D & A	3,683'
Western Minerals N. Hope Y.T. N-53	18-4-70	13-8-70	D & A	14,038'

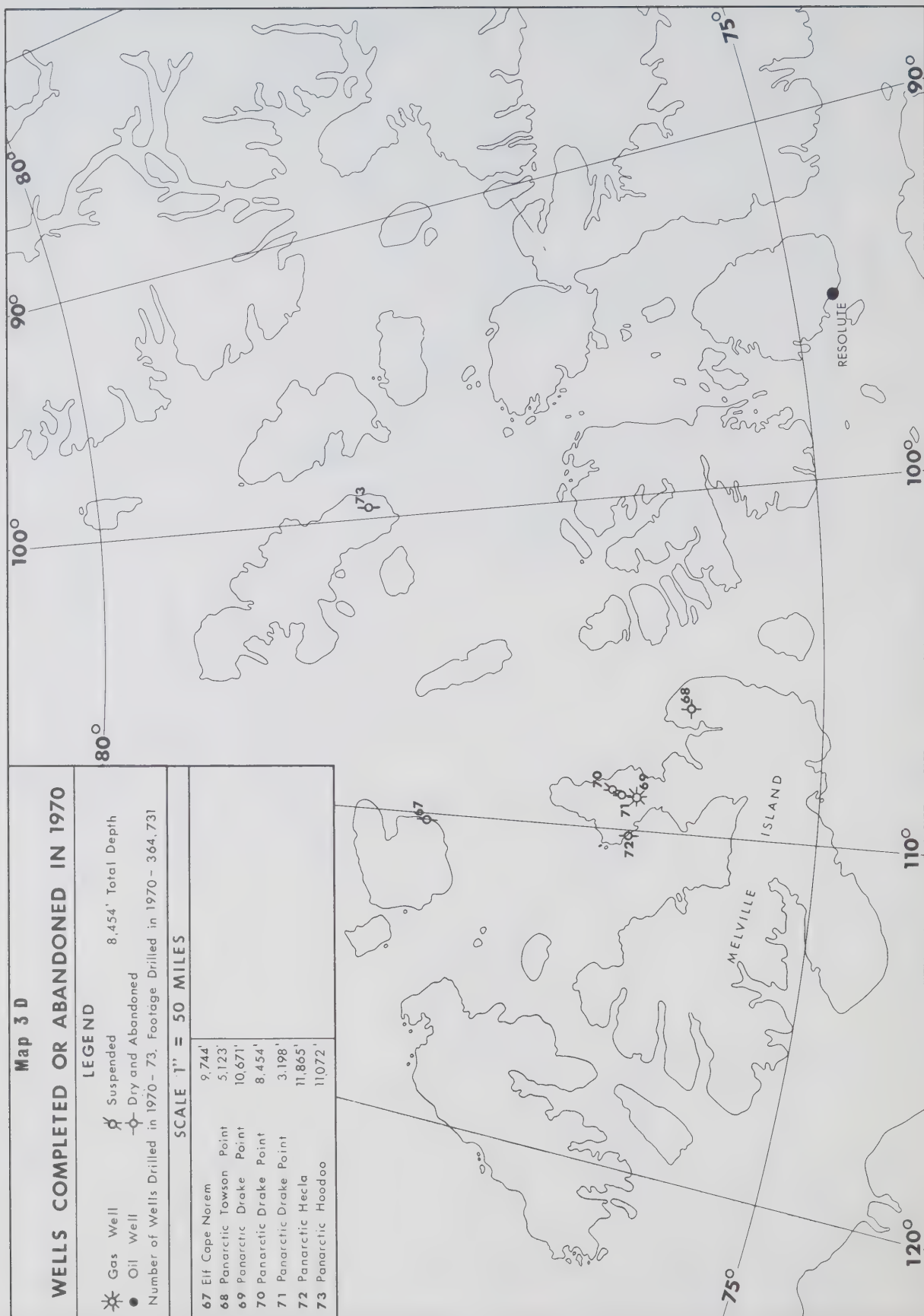
NUMBER OF WELLS DRILLED IN 1970 – 73

TOTAL FOOTAGE DRILLED IN 1970 – 364,731'









APPENDIX IV

The Oil and Mineral Division is a member of the "Federal-Provincial Committee on Energy Statistics" and the "Mine Ministers Subcommittee on Oil and Gas Statistics" and together with the four western provinces and D.B.S. has standardized all its oil and gas reporting forms. This standardization has removed duplication between government agencies and more important, industry can now process all oil and gas reporting forms from the western provinces and the Yukon and Northwest Territories on computer machines without change of programs.

FORM NO.	TITLE OF FORM
IAN*52-90-1**	Application for a Drilling Authority
IAN*52-90-2	Well Completion Data
IAN*52-90-3**	Application to Amend a Drilling Authority
IAN*52-90-4**	Application to Change a Well Name
IAN*52-90-5**	Application to Abandon a Well or Suspend Drilling
IAN*52-90-6**	Application to Alter Condition of a Well
IAN*52-90-7	Work-over Report No.
IAN*52-90-8	Application to Commingle Production before Measurement
IAN*52-90-9	Data for Back Pressure Test on Natural Gas Wells — Monograph 7 Method
IAN*52-90-10	Data for Back Pressure Test on Natural Gas Wells — Vitter's Method
IAN*52-90-11	M.P.R. — Oil — Calculations
IAN*52-90-12	New Oil Well Report
IAN*52-90-13	New Gas Well Report
IAN*52-90-17	New Service Well Report
IAN*52-90-18	Monthly Water Flood Operations Report
IAN*52-90-20	Monthly Water Receipts and Disposal of Fluid Report
IAN*52-90-23	Geologic Surface Survey & Airphoto Analysis — Expenditures
IAN*52-90-24	Land Geophysical Operations — Expenditures
IAN*52-90-25	Marine Geophysical — Expenditures
IAN*52-90-26	Drilling & Structure Test Drilling Program — Expenditures
IAN*52-91	Notice of Commencement of Exploratory Work
IAN*52-92	Application for Authority to Drill Structure Test Hole
IAN*52-93	Report on Abandonment of Structure Test Holes
IAN*52-83	Grouping Notice
IAN*52-103**	Application for Oil and Gas Lease
IAN*52-183	Monthly Accident Summary

*To be completed by Operator.

**To be completed in triplicate; all other forms to be completed in duplicate.

All forms, except IAN 52-83 and 52-103, are submitted to the District Oil Conservation Engineer, Calgary 21, Alberta.

Forms IAN 52-83, 52-90-23 to 52-90-26 and 52-103 are submitted to the Oil and Mineral Division, 400 Laurier Avenue West, Ottawa 4, Ontario.

The following forms have been issued pursuant to the "Canada Oil and Gas Land Regulations" and the "Canada Oil and Gas Drilling and Production Regulations". These forms are to be completed when applicable during the production stage of oil and gas wells, and refinery operations.

FORM NO.	TITLE OF FORM
IAN 52-116-1	Monthly Production Report
IAN 52-116-2	Monthly Disposition and Crown Royalty Statement
IAN 52-116-3	Monthly Gas Gathering Statement
DBS 6511-38*	Monthly Oil Pipeline Gathering Operations Statement
IAN 52-116-5	Monthly Crude Oil and Condensate Purchasers' Statement
IAN 52-116-6	Monthly Gas Plant Statement
DBS 6511-37*	Monthly Natural Gas Distributors Statement
IAN 52-116-8	Monthly Gas Processing Plant Products Statement
IAN 52-116-9	Monthly Liquefied Petroleum Gas Purchasers Statement
IAN 52-116-10	Monthly Refinery Operations Report
IAN 52-116-11	Monthly Gas Injection Operations Report
IAN 52-116-12	Statement of Nomination and Estimated Requirement for Crude Oil, Condensate and Pentanes Plus

NOTE: (a) All forms to be completed by the Operator.

- (b) Forms 6511-37 and 6511-38 are completed by the Operator in triplicate. He forwards the first two copies to the Oil and Mineral Division and the third to the District Oil Conservation Engineer, Department of Indian Affairs and Northern Development, Calgary, Alberta. The other forms listed above are completed in duplicate. The original is submitted to the Oil and Mineral Division in Ottawa and one copy to the District Conservation Engineer in Calgary.

APPENDIX V

Selected geological references applicable to geological provinces in northern Canada are listed below. References are Geological Survey of Canada publications unless otherwise noted.

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A.W. Norris |
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P. Harker |
| Bulletin 159 | Study of pegmatite bodies and enclosing rocks, Yellowknife-Beaulieu region, District of Mackenzie
R. Kretz |
| Bulletin 163 | A Middle Cambrian Plagiura-Poliella faunule from southwest District of Mackenzie
B.S. Norford |
| Bulletin 170 | Middle Triassic (Anisian) ammonoids from northeastern British Columbia and Ellesmere Island
F.H. McLearn |
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T.P. Chamney |
| Paper 58-2 | Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains
J.A. Jeletzky |
| Paper 58-11 | Great Slave and Trout River Map Areas
R.J.W. Douglas |
| Paper 59-11 | Horn River Map Area
R.J.W. Douglas, et al |
| Paper 61-1 | Summary Account of Carboniferous and Permian Formations Southwestern District of Mackenzie
P. Harker |

Paper 61-9	Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell Rivers J.A. Jeletzky
Paper 61-13	Camsell Bend and Root River Map Areas R.J.W. Douglas, et al
Paper 61-18	Geological Notes — Northern District of Keewatin W.W. Heywood
Paper 61-29	Upper Devonian Formations H.R. Belyea, et al
Paper 62-15	Middle Devonian and Older Paleozoic Formations of Southern District of Mackenzie H.R. Belyea, et al
Paper 62-33	Dahadinni and Wrigley Map Areas R.J.W. Douglas, et al
Paper 65-32	Geophysical Reconnaissance of Hudson Bay Peter Hood
Paper 66-50	Jurassic and Triassic Rocks of the Eastern Slope of Richardson Mountains Northwestern District of Mackenzie J.A. Jeletzky
Paper 67-8	Preliminary account of the Goulburn Group, Northwest Territories, Canada L.P. Tremblay
Paper 67-53	Reconnaissance Devonian stratigraphy of northern Yukon Territory and northwestern District of Mackenzie A.W. Norris
Paper 68-25	Subsurface geology, Lower Mackenzie River and Anderson River area, District of Mackenzie E.J. Tassonyi
Paper 68-47	Sekwi Formation, a new lower Cambrian formation in the southern Mackenzie Mountains, District of Mackenzie R.C. Handfield
Paper 68-36	Preliminary notes on the Proterozoic Hurwitz Group, Tavani (55K) areas, District of Keewatin R.T. Bell

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Papge 69-9	Stanton map-area, Northwest Territories (107D) C.J. Yorath and H.R. Balkwill
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| Geog. Bull 4
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Y.O. Fortier |
| Paper 59-13 | Aeromagnetic Surveys Across Hudson Bay from Churchill to Coral Harbour and Churchill to Great Whale River

M.E. Bower |
| Paper 60-20 | Belcher Islands

G.D. Jackson |
| Paper 63-48 | Sedimentology of Hudson Bay

R.J. Leslie |
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R.L. Christie |

- Paper 67-60 Geology of the Hudson Bay Lowlands Operation Winisk
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 Kaskattama Province No. 1 well, northern Manitoba
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Indian and
Northern Affairs

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Oil and Gas Activities 1971



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Oil and Gas Activities 1971

A Report of Activities in 1971 of the Oil and Gas Industry in the Yukon Territory and Northwest Territories

Compiled by Oil and Gas Land and
Exploration Section
Oil and Mineral Division
Northern Economic Development Branch

(Edition No. 8)

Issued under the authority of
Hon. Jean Chrétien, PC, MP, Minister of
Indian Affairs and Northern Development
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Catalogue No. R71-6/1971
IAND Publication No. QS-1212-000-EE-A-1

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INTRODUCTION

All aspects of oil and gas operations in the Yukon and Northwest Territories are administered by the Department of Indian Affairs and Northern Development, specifically by the Oil and Mineral Division. It is the intent of the Department to provide a regulatory climate that will best encourage and provide for the orderly exploration and exploitation of oil and gas thereby achieving benefits of a local nature to the specific areas involved and to the people of Canada in general through the attendant revenues accruing to the Crown.

The Minister and officers of the Department of Indian Affairs and Northern Development as of July 1, 1972, who are responsible for administering oil and gas resources in the Northwest Territories and Yukon Territory, and northern offshore areas, are:

Minister	— The Hon. Jean Chrétien, P.C., M.P.
Deputy Minister	— H.B. Robinson
Assistant Deputy Minister (Northern Development)	— A.D. Hunt
Director	— A.B. Yates
Northern Economic Development Branch	
Chief, Oil and Mineral Division	— Dr. H.W. Woodward
Administrator, Oil and Gas	— R.R. McLeod
Supervisor, Geological Operations Unit	— S.A. Kanik
Supervisor, Geological Evaluation Unit	—
Supervisor, Land Unit	— P. Sullivan
Chief Petroleum Engineer	— Dr. H.J. Berry
Regional Oil & Gas Conservation Engineer	— M.D. Thomas in Yellowknife
District Oil and Gas Conservation Engineers	— A.J. McCaskill for Arctic Islands in Calgary
	— for N.E. Sector in Inuvik
	— for N.W. Sector in Inuvik
	— G.E. Blue for S.W. Sector in Yellowknife
	— R. Price for S.E. Sector in Yellowknife

POTENTIAL OF THE GEOLOGIC BASINS

Geologic Summaries

In Canada, north of Latitude 60° the areas outside the provinces contain 1,458,784 square miles, of this a total of 465,000 square miles are underlain by sedimentary rocks (Map No. 1) ranging from Cambrian to Tertiary that are considered to be potentially productive of oil and gas. The vast Territories sedimentary regions can be divided conveniently into several geological provinces each characterized by specific features of the contained sediments or structures in which they are involved. Hence a summary of the sedimentary geological provinces is given which focuses attention to their location and potential of these geological provinces, and a selected list of relevant geological references is included. The reports listed for the Sverdrup Basin and the Franklinian Geosyncline are in large part also applicable to other basins in the Arctic Archipelago. All geologic references are listed in Appendix V.

Interior Plains

The Interior Plains are commonly referred to as the Western Canadian Sedimentary Basin. In this context the Liard Plateau and Mackenzie Plains are included in this geological province. The sediments range from Lower Paleozoic to Cretaceous and thicken westward into the Cordilleran Geosyncline.

Porous sandstones and carbonates are present in many formations within the sedimentary column. Gas discoveries have been made at Rabbit Lake, Netla, Celibeta, Island River, Trainor Lake, Beaver River and Pointed Mountain. The Norman Wells oil field is located on the Mackenzie Plains west of the Franklin Mountains.

Arctic Lowlands

The Arctic Lowlands consist of several basins lying between the Franklinian Geosyncline and the Canadian Shield on the mainland. It is not known whether they are structural or depositional in origin. Sediments consist of carbonates and clastics, and range from Cambrian to Mesozoic and Tertiary. Thickness of sediments probably does not exceed 10,000 feet and the principal rocks are carbonates of Ordovician and Silurian age.

Franklinian Geosyncline

The Franklinian Geosyncline encompasses sedimentary basins in the Arctic Archipelago that include the Ellesmere fold belt, Cornwallis and Parry Island fold belts. Most of the structures are generally characterized by long, wide, symmetrical folds. Sediments range from Cambrian to Permian and thicknesses may range up to 20,000 feet.

Much of the early exploration in the Arctic was concentrated in this geologic province, in 1962-64 three wells were abandoned. They were:

Dome et al Winter Harbour No. 1
Lobitos et al Cornwallis Resolute Bay L-41
Dom. Explorer et al Bathurst Caledonian R.J-34

In 1970 Panarctic Oils Ltd. drilled only one well, Panarctic Towson Point F-63 in this basin. In 1971 Panarctic Oils Ltd., Sun Oil Ltd., and farmeers drilled a total of six wells in this geologic basin.

Sverdrup Basin

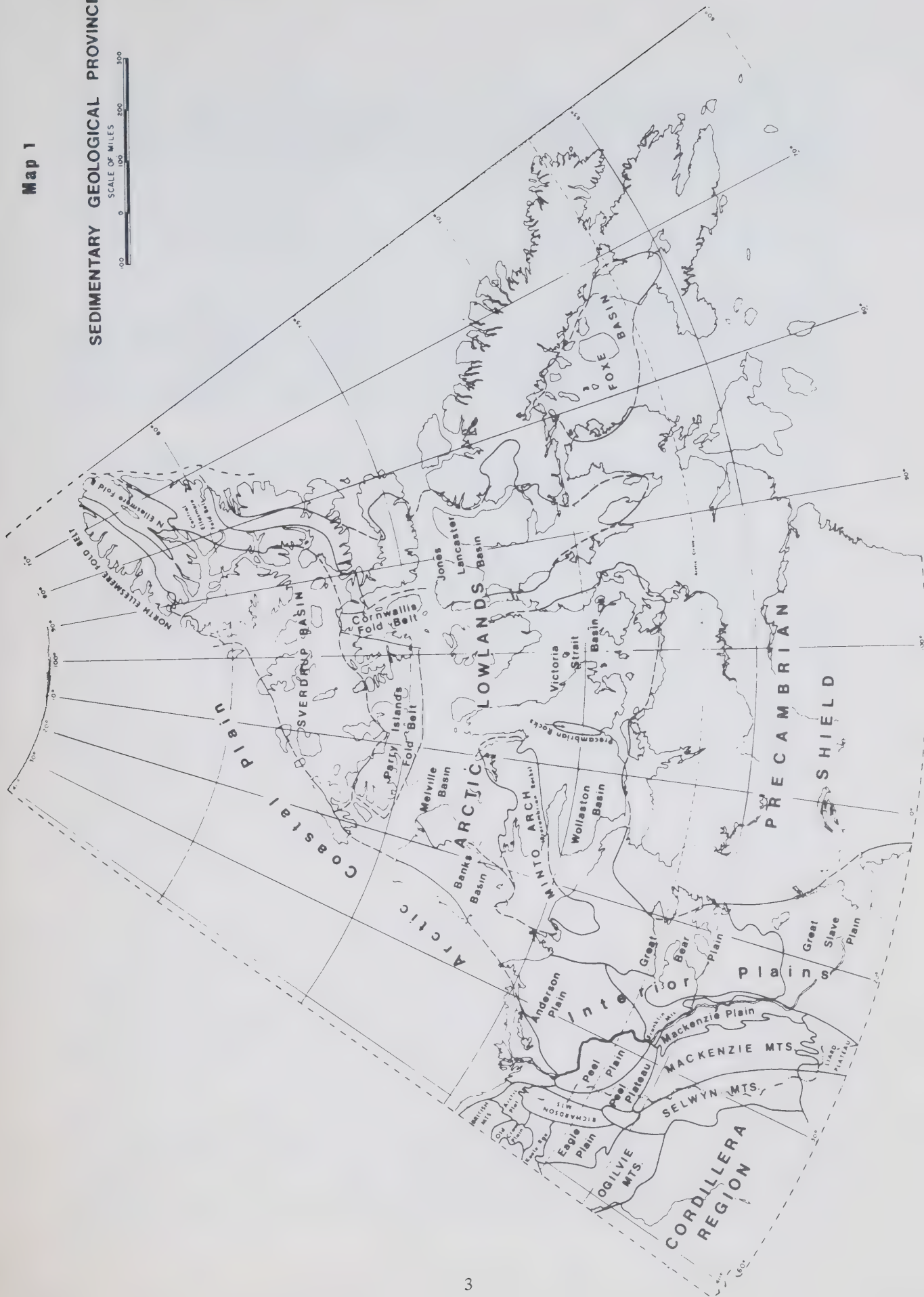
The Sverdrup Basin may contain one of the thickest sequences of sediments in North America. Composite thicknesses are in the order of 60,000 feet and range in age from late Paleozoic to early Tertiary. The principal rocks are Pennsylvanian, Permian and Triassic. Reservoir rocks consist of thick sections of limestone reefs and sandstone. The Bjorne formation of Triassic age contains oil impregnated sands on Melville Island, significant evidence of hydrocarbons in the sediments of the Arctic Islands.

The major structures are large symmetrical folds that include Tertiary beds. In certain areas of the Basin, piercement domes, evaporite diapirs, sills and dykes are mapped. These secondary structures may form trapping mechanisms for hydrocarbon accumulation.

During 1971 Panarctic Oils Ltd., drilled a total of seven wells in the Sverdrup Basin. One of the wells, Panarctic Kristoffer Bay G-06 on Ellef Ringnes Island is a completed gas well. In addition a second gas discovery was made at Panarctic King Christian N-06 followed by an oil discovery at Panarctic Tenneco at al Thor P-38 in May, 1972.

Map 1

SEDIMENTARY GEOLOGICAL PROVINCES



Foxe Basin

The Foxe Basin is generally less than 300 feet in elevation and underlain by flat lying Paleozoic rocks. Recent work indicates that the outcrops are Ordovician and bear distinct similarity to rocks on Cornwallis Island. The detailed stratigraphy is unknown, therefore the thickness can only be surmised to be 3,000 to 4,000 feet.

A well drilled by the Aquitaine Group on Rowley Island in 1971 encountered Pre-Cambrian granite below 1700 feet.

Hudson Bay Basin and Lowlands

Sedimentary rocks in the Hudson Bay area, which include the large Islands, are of Ordovician, Silurian, Devonian, and Mesozoic age. The Paleozoics are correlated with rocks in Manitoba while many of the fossils can be compared to fauna of the same age in Ontario. Magnetometer and seismic surveys in the Bay indicate that between 5,000 and 10,000 feet of sediments may be present.

Structurally the sediments dip basinward while the carbonate rocks on Southampton and Coates Island appear to be essentially flat lying.

Arctic Coastal Plains and Continental Shelf

The Arctic Coastal Plains geographically are located along the northwest fringe of the Arctic Archipelago and geologically include the Continental Shelf. The area is overlain by Tertiary and Pleistocene sediments and dip oceanward. Very little is known about the sequence of sediments but in northern Yukon up to 30,000 feet of Mesozoic rocks are present. On the Continental Shelf, it is expected that Tertiary sediments overlie the Mesozoic so the combined thickness could be considerable greater.

The Continental Shelf (see Map No. 1) extends between two to three hundred miles west of the islands and although a potential oil and gas province, the permanent polar-ice conditions may place severe restrictions on exploration in offshore areas.

Imperial Oils' and Gulf Oil's drilling programs in the Mackenzie Delta have met with excellent success in that a total of four gas wells and two oil wells have been discovered to date. Off-set wells, according to the companies, are confirming the presence of large and significant gas and oil reserves.

Eagle Plain

The Eagle Plain is one of several complex structural basins in the northern Yukon. The area from the Ogilvie Mountains to the Arctic Coastal Plains is underlain by a thick succession of sedimentary rocks representing most of the geologic systems. The principal rocks of interest are late Paleozoic to Mesozoic which consist of porous carbonates and thick sequences of sandstone. Oil and gas were discovered in two wells and oil in one well, all in rocks of Pennsylvanian age.

Geologic structures in the Eagle Plain are parallel to the mountain ranges such as the Richardson, Old Crow and Keele Ranges. They consist of north-south trending folds, many enechelon patterns. Strong regional unconformities separate rocks of each system thus producing many potential stratigraphic traps for hydrocarbons. Several periods of deformation have added to the complexities of the geology in the intermontane basins of northern Yukon.

Area and Volume of Sediments

In sedimentary areas, which are relatively unexplored by drilling, there are various ways in which an estimate of the possible oil and gas potential may be made. One of the more commonly used methods is that of estimating the volume of sediments within the basins and comparing these with other sedimentary basins of the world in more advanced stages of development.

The area of the islands underlain by sedimentary rocks is about 350,000 square miles. Since measured and estimated stratigraphic sections are widely dispersed, an approximation for the average thickness was taken to be 10,000 feet. For purposes of computing the volume of sediments, only the areas between the 1,000 feet isopachous lines were used, and the thickest sedimentary sections were used. The thickest sedimentary sections were taken to be 16,000 feet. Below 16,000 feet, very few wells are productive from the older sediments, although younger sediments at this depth may provide excellent reservoirs. On this basis the volume of sediments in the Northwest Territories and Yukon is approximately 332,000 cubic miles.

A comparison of the sedimentary areas and volumes in the Western Provinces and in the Yukon, Northwest Territories and Arctic Islands is given in Table No. 1.

TABLE NO. 1
Volume of Sediments

Area	Area (Sq. Miles)	Volume of Sediments (Cu. Miles)
Manitoba and Saskatchewan	176,623	168,072
Alberta	236,893	341,715
British Columbia	50,688	115,318
Yukon	43,000	64,500
Northwest Territories	204,794	267,133
Arctic Islands	350,000	663,500
	1,061,998	1,620,238

Oil and Gas Discoveries

Norman Wells is the only producing oil field North of the 60th parallel. The field was discovered in 1920, but intensive commercial development did not take place until World War II. During 1971 oil was produced at an average rate of 2,800 barrels daily and refined locally.

Imperial Oil discovered oil at its Atkinson H-25 well in January 1970. A company announcement stated that "Oil flowed to the surface from the 5,700 foot level. Further testing is required to evaluate this field". Offsetting wells, nearest one about 3-1/2 miles away, were dry and abandoned. A second oil discovery was made in their IOE Mayogiak J-17 well. The company announced that oil flowed from the 3800 and 9000 foot levels.

To date gas has been discovered in ten separate wells in the Northwest Territories mainland and in three wells in the Arctic Islands. Taglu and Pointed Mountain are the only gas fields currently under development, the latter gas field will go on stream on November 1, 1972, when the pipeline built during the winter of 1971-72 will tie into the Fort Nelson-Beaver River gas pipeline.

Panarctic Oils Ltd., in 1971, drilled one successful gas well on Ellef Ringnes — Panarctic et al Kristoffer Bay G-06. This brings to three the number of gas discoveries on the Arctic Islands by Panarctic to the end of 1971. It follows up the 1969 Panarctic gas discovery on Drake Point, Melville Island, and in 1970, Panarctic discovered gas on King Christian Island. These discoveries will be evaluated in the near future, to determine the areal extent of reservoirs.

Significant gas discoveries were made on the Eagle Plain and the northern extension to the Beaver River gasfield in the Yukon Territory. The Beaver River gasfield went on stream in October, 1971.

In the Eagle Plain, four gas wells were drilled and suspended after the discovery of oil and gas at the Western Minerals Chance Y.T. No. 1 (M-08) well in 1960. Lack of potential markets have deterred the development of these wells. (See Appendix II for complete list of Oil and Gas Discoveries).

Reserves

A. Crude Oil Reserves

The geological basins comprising the Territories and Arctic Islands are only in the initial stages of exploration, so definitive crude oil reserves have little meaning at this time. However, the "Potential Reserves of Crude Oil Recoverable by Conventional Methods", compiled by the Canadian Petroleum Association, and released in April, 1969, are considered authoritative. The Canadian Petroleum Association report states that the potential crude oil reserves for "all of Canada recoverable by conventional means is 120.8 billion barrels, of this total, 43.45 billion barrels is assigned to the Arctic Islands and Coastal Plain area; and (by interpolation) approximately 15 billion are calculated for the rest of the Northwest Territories and the Yukon Territory. Thus, about 60 billion barrels of oil, or 50% of the total potential of Canada was computed to be located North of 60.

The Association, in an annual report outlining the reserves for Canada, states that at December 1, 1970 proved reserves assigned to the Northwest Territories (Norman Wells field) were 45.21 million barrels".

B. Natural Gas Reserves

In the April 1969 report, the "Potential Raw Gas Reserves" for Canada are given as 724.8 trillion cubic feet. The potential reserves computed for the Arctic Islands are 260.7 trillion cubic feet; those for the rest of the Northwest Territories and the Yukon Territory (by interpolation) are calculated at approximately 90 trillion cubic feet.

Recent reports of reserves are given by the Canadian Petroleum Association as 1.006 tcf Proved and 1.403 tcf Proved and Probable for the Pointed Mountain gas field. The report did not assign any gas reserves to the Yukon portion of the Beaver River gas field, to 12 individual gaswell discoveries in the Yukon and Northwest Territories or to the two gas discoveries in the Arctic Islands.

REFINING OPERATION

Refining Capacity

As noted in a previous section the only operating refinery located north of 60 is at Norman Wells and is operated by Imperial Oil Ltd. This refinery has a calendar day capacity of 1,500 barrels and a stream day capacity of 1,600 barrels. An extensive modernization program to increase refining capacity to more than 2,000 barrels per day was commenced in 1969 and completed in 1971. In addition, other facilities such as barrel-filling, wharf-loading and water-purifier were enlarged and improved.

ACTIVITIES – 1971

Land

As may be seen in the land map (Map No. 1) Figure No. 1, and in Table No. 2, 1971 was characterized by additional filings in the Arctic Islands, Davis Strait and on the mainland of the Northwest Territories. Peripheral acreage was surrendered in seacoast areas on the Continental Shelf and along the eastern margins of the Interior Plains basins.

TABLE NO. 2
Number of Permits and Leases and
Relevant Acreage – 31 December 1971

PERMITS		
Area	No.	Acreage
N.W.T. Mainland	2,257	99,320,100
Y.T. Mainland	609	24,736,657
Arctic Islands(1)		
off-shore (N of 70)	3,376	165,887,259
on-shore (N of 70)	2,044	101,841,586
Arctic Coast Marine (2)	1,513	72,745,539
Total	9,799	464,531,141
LEASES		
N.W.T. Mainland	719	4,436,793
Y.T. Mainland	63	252,222
Arctic Islands(1)	---	---
Arctic Coast Marine (2)	---	---
Total	782	4,689,015

(1) All areas North of 70°

(2) All areas South of 70° covered by seacoast waters.

The net result was that the number of Permits terminated exceeded the number of N.W.T. issues in the mainland areas of the Territories by 96 permits and in the Yukon by 16 permits. A small increase in total acreage was evident in the Arctic North of 70, despite the termination of sizable holdings in the Queen Elizabeth Islands.

Interest continued to be high in the Davis Strait and Baffin Bay areas where industry acquired some 1,135 permits covering 57 million acres. The Department currently has applications for permits covering about 17 million acres under review in this active play.

As a result of the maturing permits in the southern mainland areas, the number of leases held by industry increased by more than 750,000 acres in 105 leases. This increase in lease holdings contributed to the decline in the number of mainland permits. The trend of leasing illustrated in Figure No. 2 is expected to continue throughout 1972 and accelerate in 1973 and in later years.

No major changes in the overall industry holdings in the primary sedimentary areas are anticipated before mid-year 1973, however, new developments could substantially affect the

holdings in seacoast areas, particularly those in Foxe Basin, the Davis Strait and Baffin Bay. No public offerings of oil and gas rights were made during 1971.

Rentals increased for oil and gas leases in the Northwest Territories by \$2,800,000 and by \$150,000 in the Yukon Territory, during the calendar year 1971 over the previous year. Rentals and special rental fees should increase in 1972 to a new high of about 5 million dollars.

Oil and Gas Regulations

The only amendment to the Canada Oil and Gas Land Regulations in 1971, was the revision of Sections 38 and 109 to provide notice of defaults on renewals. Under this amendment, a permittee will be given notice of default and a 90-day period in which to submit his deposits for the next work period. Land Order 1-1961 was revoked in 1970 and during 1971 Crown Reserves could only be disposed of under the terms of Section 58, and Land Orders Nos. 2-1961, and 1-1962.

Permit Term and Work Requirement Zones are illustrated in Figure No. 3. Note that permit terms for water permits west of Longitude 90° are slightly different from those east of 90°. In Figure No. 4 the Permit Term and Deposit Requirement are graphically described. There have been no changes since 1968.

Land Order No. 1-1961 prior to Revocation set out a schedule of Additional Rates by Areas. These are shown in Figure No. 5. Figure No. 6 is a Flow Diagram of Disposal of Oil and Gas Rights. It also illustrates the primary disposal of permits and leases, and shows the methods of acquiring leases by tender.

Exploration

Figures 7, 8, 9 and 10 graphically depict exploration activities North of 60 in 1971. Expenditures on oil and gas exploration in the Northwest Territories and Yukon Territory exceeded 169 million dollars in 1971, an increase of about 40 million dollars over the previous year. Exploratory and development drilling expenditures increased 25%, up to 75 million dollars, while total geological and geophysical expenditures increased 50% to over 94 million dollars. Expenditures for exploration drilling and seismic exploration exceeded similar work in every province and the combined Atlantic and Pacific offshore areas.

Figure No. 7 indicates that expenditures increased by 40% in 1970 and by 34% in 1971. Indications to mid-year 1972 are that these expenditures will again increase in 1972, best estimates are that they may approximate 190 million dollars. By 1975 expenditures related to oil and gas activities should reach 250 million dollars per year.

Seismic crew months, depicted in Figure No. 8, is an excellent barometer of the magnitude of drilling activity for the next two years. In 1971, oil companies conducted 230 crew months of seismic work on land and marine areas, maintaining the same level as in the previous year. This would indicate that drilling activity should maintain the same level in 1972, or increase slightly.

Figures 9 and 10 illustrate the number of wells drilled and the amount of footage drilled during the past 10 years. Note that footage has quadrupled since 1968. This is also reflected in the expenditures increase for drilling, in that there has been a 10 fold increase in drilling expenditures during the same interval.

Canada Lands are administered by the Department of Indian Affairs and Northern Development north of the heavy line. Offshore areas elsewhere administered by the Department of Energy, Mines and Resources

Map 2 OIL & GAS LAND ACQUISITIONS NORTH OF 60°



- Acquired prior to 1968
- Acquired Jan. 1, 1968 to Dec. 31, 1971
- Oil Well
- Gas Well



Fig. 1
ACREAGE HELD UNDER OIL & GAS PERMIT
 YUKON TERRITORY AND NORTHWEST TERRITORIES

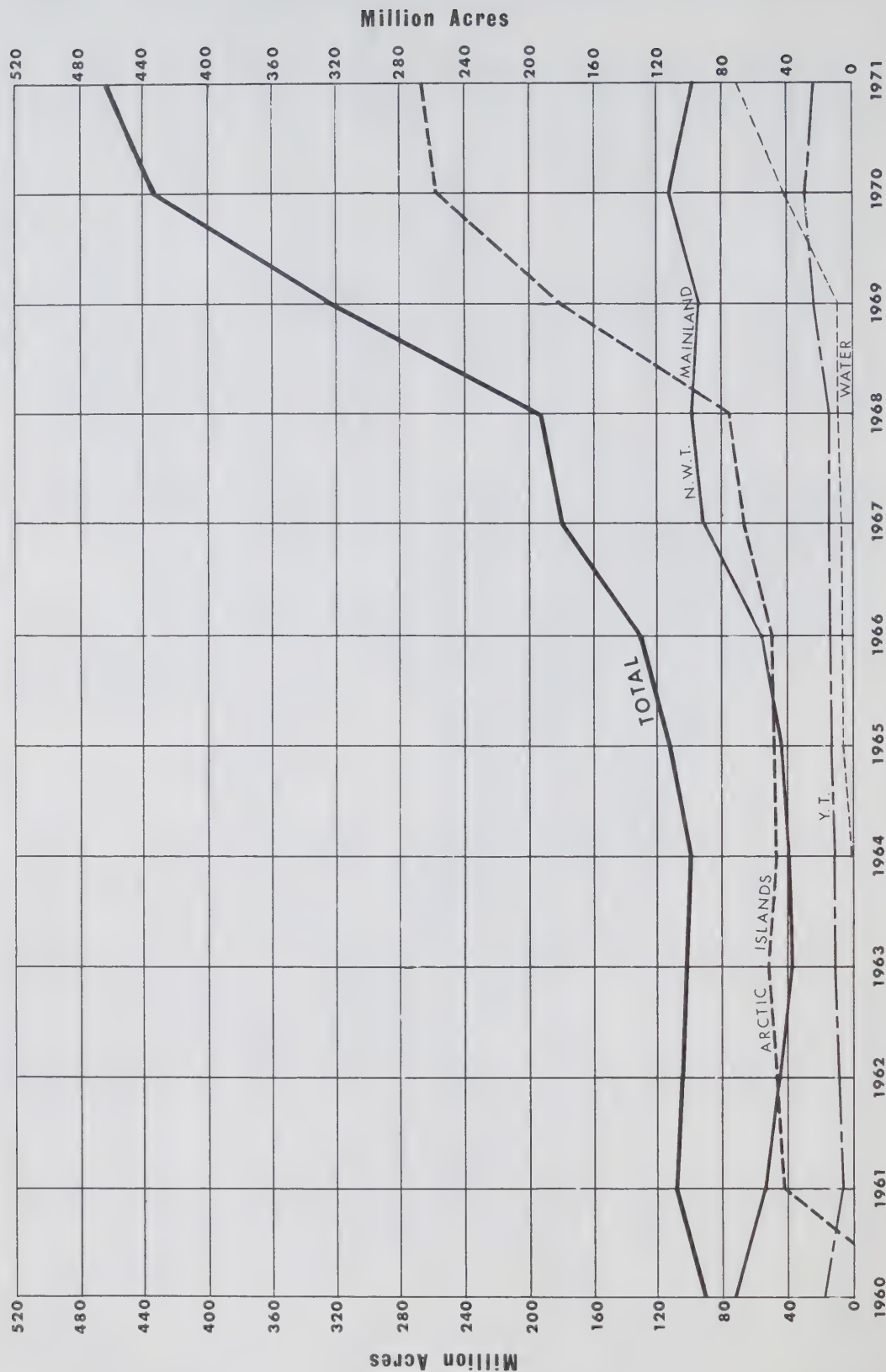
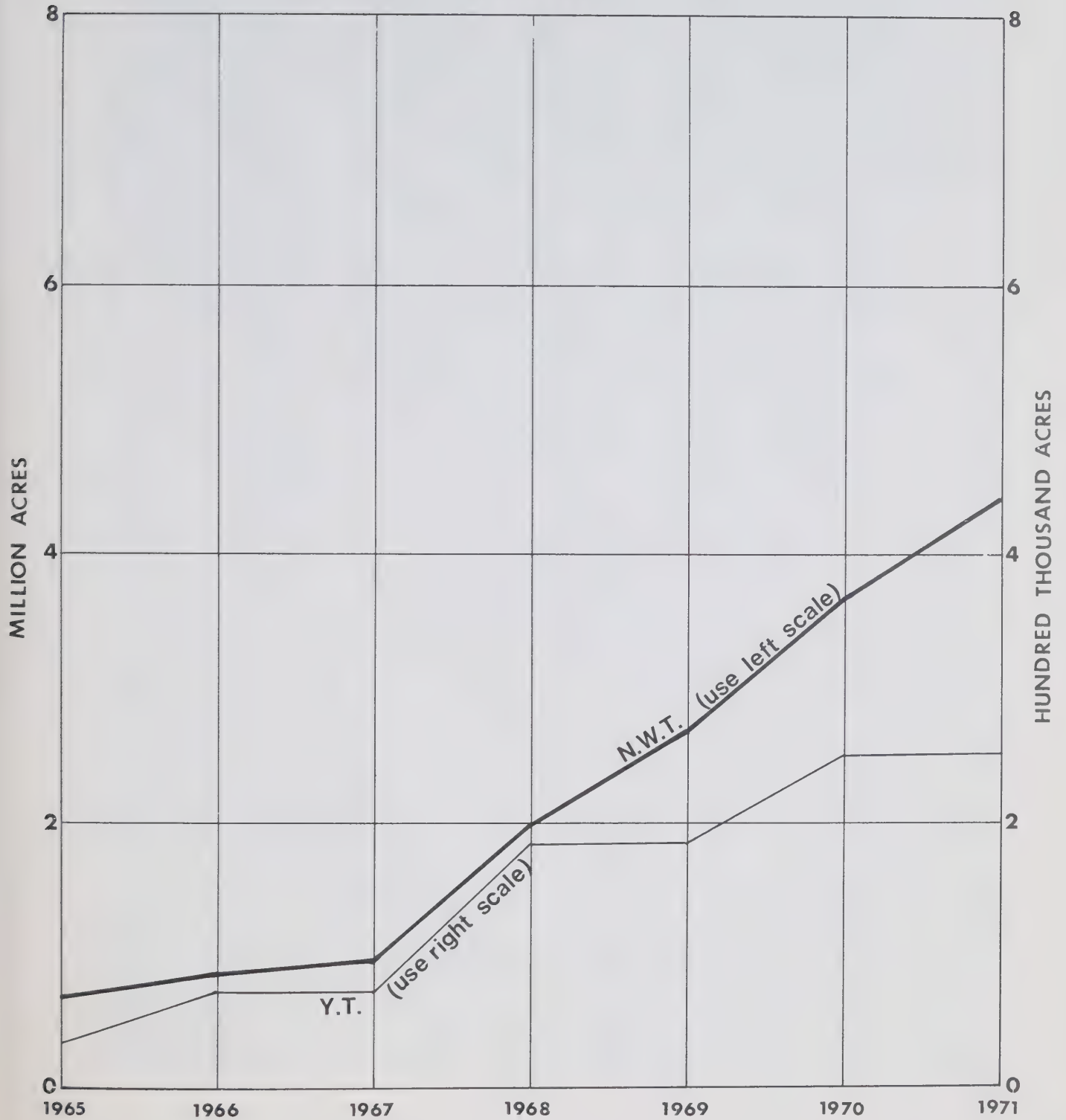


Fig. 2
YUKON TERRITORY - NORTHWEST TERRITORIES

ACREAGE UNDER LEASE
BY YEAR





Photograph No. 1 — Moving seismic camp in the Mackenzie Delta (Courtesy — Imperial Oil)

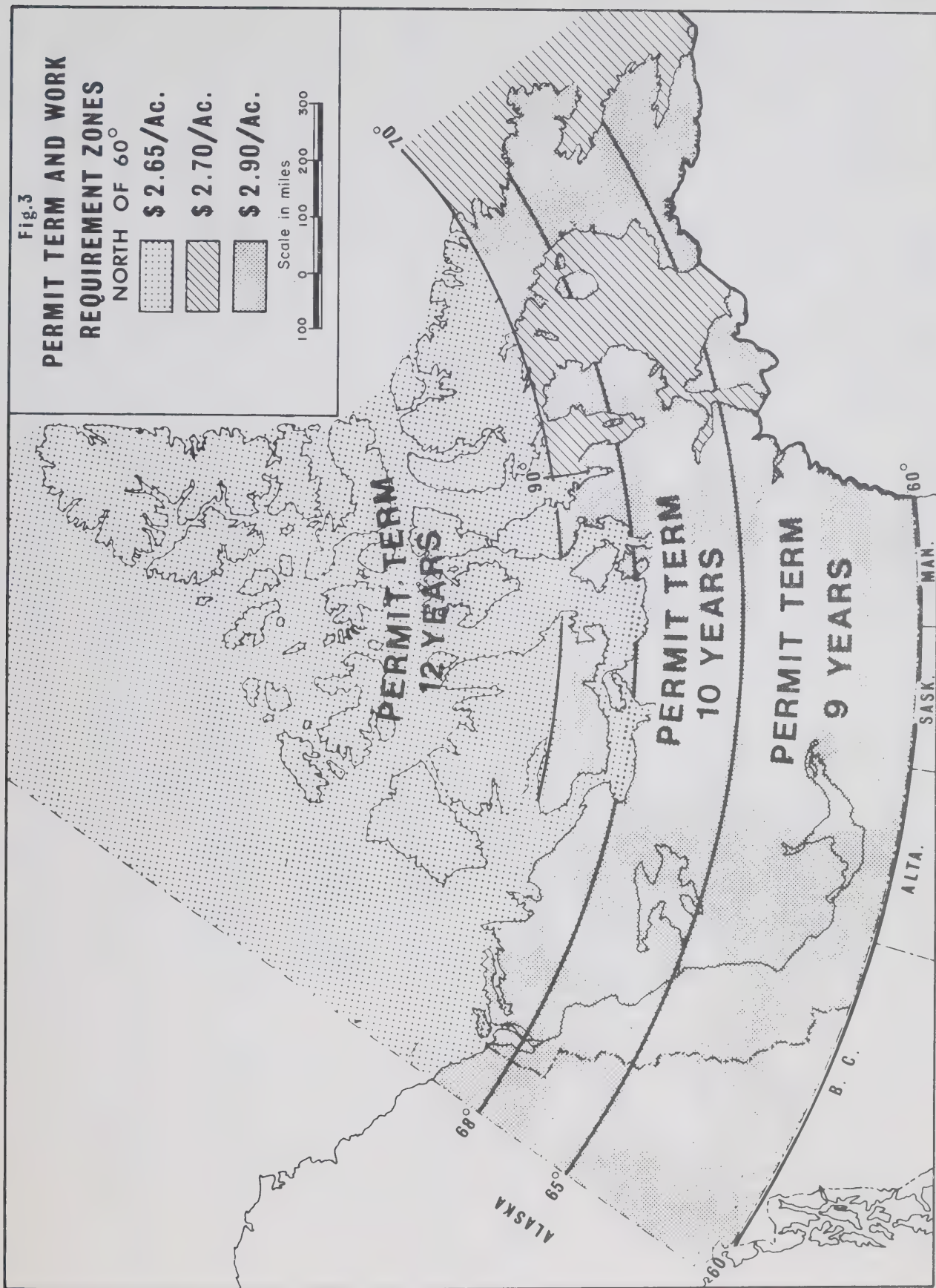


Fig. 4

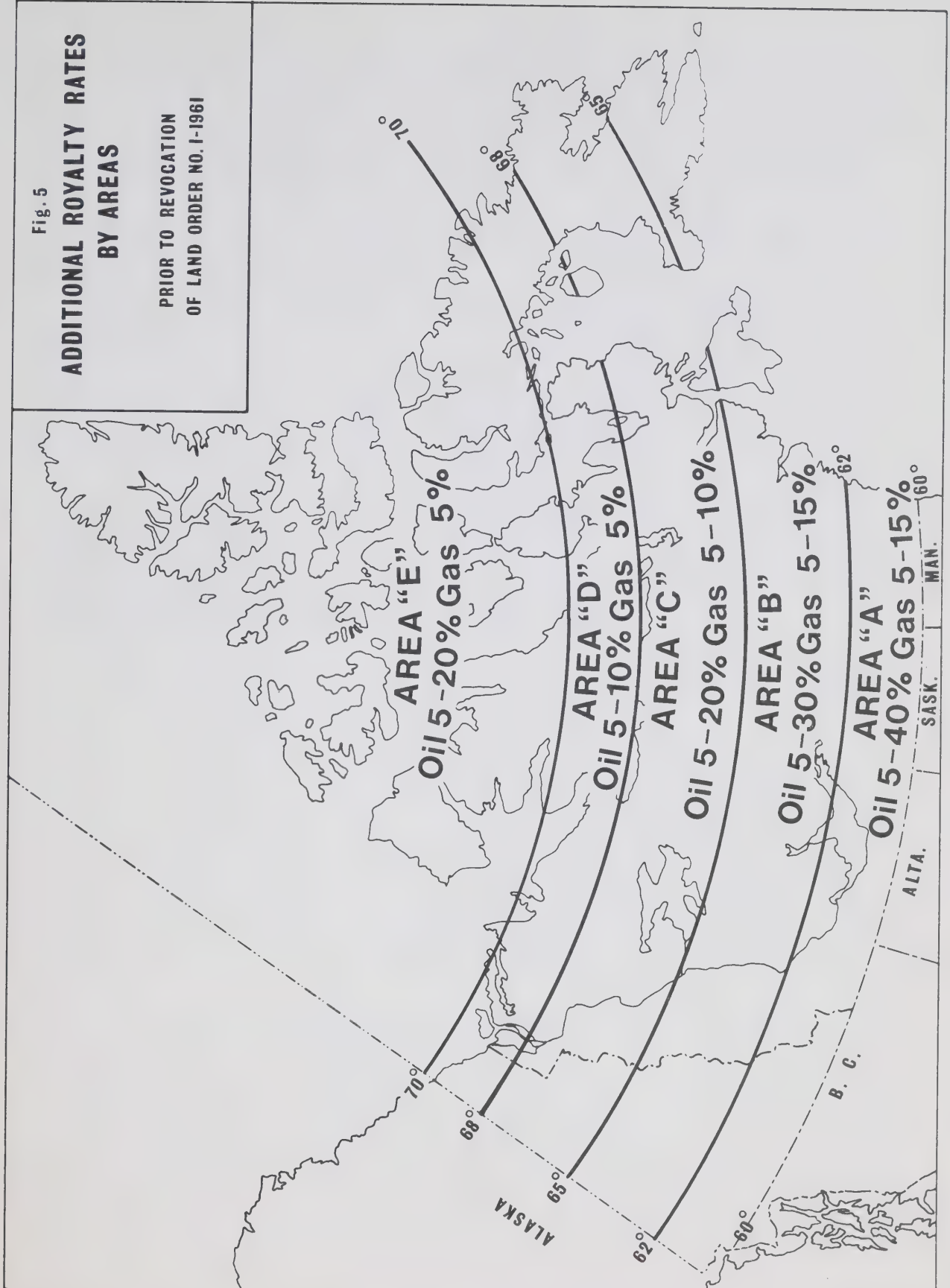
YUKON TERRITORY - NORTHWEST TERRITORIES
PERMIT TERMS AND DEPOSIT REQUIREMENTS — PER ACRE

PERMITS LOCATED BETWEEN LATITUDES	RENEWAL TERMS														TOTAL WORK REQUIREMENTS
	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs	
60° - 65°	3 YEARS														\$ 2.90
	5 ¢														
	15 ¢														
65° - 68°	4 YEARS														\$ 2.90
	5 ¢														
	15 ¢														
68° - 70°	6 YEARS														\$ 2.90
	5 ¢														
	15 ¢														
NORTH OF 70°	6 YEARS														\$ 2.65
	5 ¢														
	15 ¢														
MARINE PERMITS LOCATED SOUTH OF 70° N WEST OF 90° W	6 YEARS														\$ 2.65
	5 ¢														
	15 ¢														
SOUTH OF 70° N EAST OF 90° W	6 YEARS														\$ 2.70
	5 ¢														
	15 ¢														
PERMITS LOCATED NORTH OF 70° ISSUED PRIOR TO 1968	8 YEARS														\$ 2.65
	5 ¢														
	15 ¢														
MARINE PERMITS SOUTH OF 70° ISSUED PRIOR TO 1969	6 YEARS														\$ 2.70
	5 ¢														
	15 ¢														

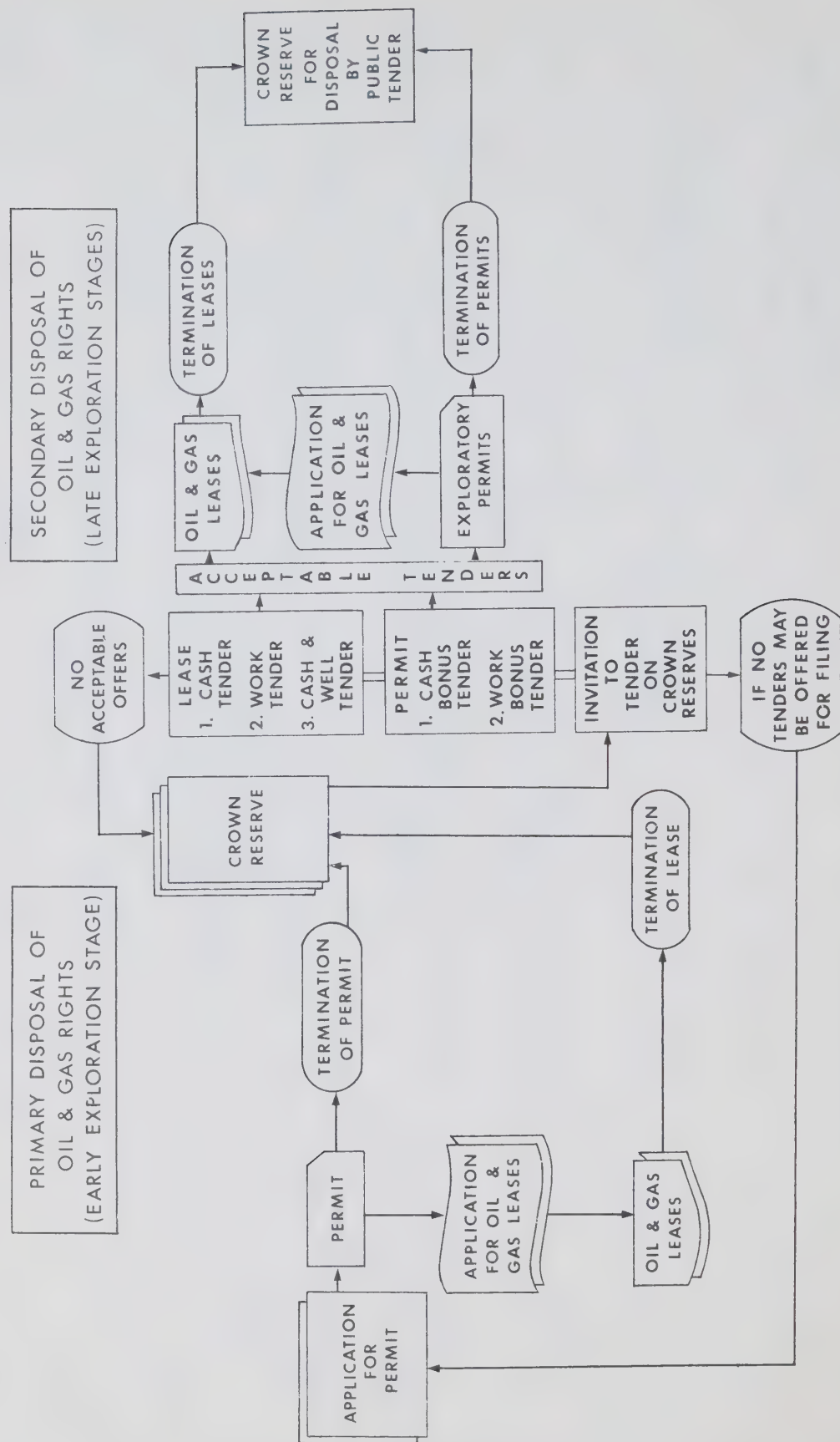
Fig. 5

ADDITIONAL ROYALTY RATES BY AREAS

PRIOR TO REVOCATION
OF LAND ORDER NO. 1-1961



FLOW DIAGRAM OF DISPOSAL OF OIL AND GAS RIGHTS



Operations

Significant acquisitions of acreage by application were made by several companies during 1971. Gulf Oil Canada Ltd. applied for over 5.0 million acres east of Devon Island and Southern Ellesmere Island. This was followed by Shell Canada Ltd. for 11.2 million acres in the Davis Strait-Lancaster Sound area. Hudson Bay Oil and Gas Company applied for over 5.1 million acres in the Davis Strait. On the Mainland R.A. Seaton acquired 2.0 million acres north of Great Bear Lake. Scattered acreage in small lots was acquired in many areas by a variety of companies and individuals.

Permits were surrendered or cancelled along the periphery of many basins on the Mainland and Arctic Islands.

Surface geological and photogeological surveys totalling 135 geological crew months were carried out on Canada Lands North of 60. Participation surveys by V. Zay Smith and Associates, Geophoto Services Limited and J.C. Sproule and Associates contributed significantly to the total surface exploration program. Chevron Standard and Imperial Oil Ltd. continued surface exploration in the northern Yukon Territory and Northwest Territories, while Panarctic Oils Ltd., Atlantic Richfield Oil Company and Canada Cities Service continued major mapping programs on the Arctic Islands.

Seismic activity was general over many of the geological basins in the north. Detailed seismic work was carried out by many companies in the southern part of the Northwest Territories and on the Peel Plateau. Imperial Oil Enterprises, Gulf Oil Canada Ltd. and Shell Oil Canada continued to carry out large reflection programs along the Arctic Coastal Plain and in the Mackenzie Delta-Tuk areas. Chevron Standard carried out an extensive seismic program during the winter and summer of 1971 on the Eagle Plain.

In the Arctic Islands major seismic programs were continued by Elf Oil Canada on Banks Island, while Panarctic Oils Ltd., Sun Oil Company and Imperial Oil Ltd. continued large scale reflection seismic programs over most of the Arctic Islands.

Drilling activity was highlighted by large and extensive drilling programs in the Tuk-Delta area and Arctic Islands. In the Tuktoyaktuk area Imperial Oil continued to drill stratigraphic tests. One of the wells, IOE Mayogiak J-17 test flowed oil to the surface from the 9,000 foot level. This well has also encountered oil and gas during tests at the 3,800 foot level. In June 1971, Imperial Oil announced that its IOE Taglu G-33 and P-03 wells encountered gas in significant volume on tests. In the Arctic Islands, Panarctic Oils Ltd. drilled one successful gas well on Ellef Ringnes Island, Panarctic et al Kristoffer Bay G-06. This brings to three the number of gas discoveries on the Arctic Islands by Panarctic to the end of 1971. It follows up the 1969 Panarctic gas discovery on Drake Point on Melville Island and in 1970, Panarctic discovered gas on King Christian Island.

In the Yukon Territory, Chevron Standard drilled and abandoned seven wildcat tests on the Eagle Plain without finding hydrocarbons.

The number of "wells drilled" and seismic "crew months" worked will increase during 1972. Extensive seismic programs are being carried out in the Beaufort Sea and with ice breaker assistance in the Lancaster Sound, Viscount Melville Sound and Norwegian Bay areas. The continuation of wildcat drilling in the Arctic by Panarctic Oils Ltd, Imperial Oil and Gulf Oil Canada, the wildcat drilling in the Delta areas by the major companies, will increase the number of wells drilled to at least 85 in 1972. Drilling activities and seismic activities will increase substantially in the other areas and total exploration expenditures may exceed 190 million dollars in 1972.

Participation and Research Projects

Approximately 25 participation and research-type projects were initiated or continued during 1971. Expenditures incurred for these projects qualify for work credits and when approved can be applied to permits in certain designated areas. Major programs in these categories during 1971 were:

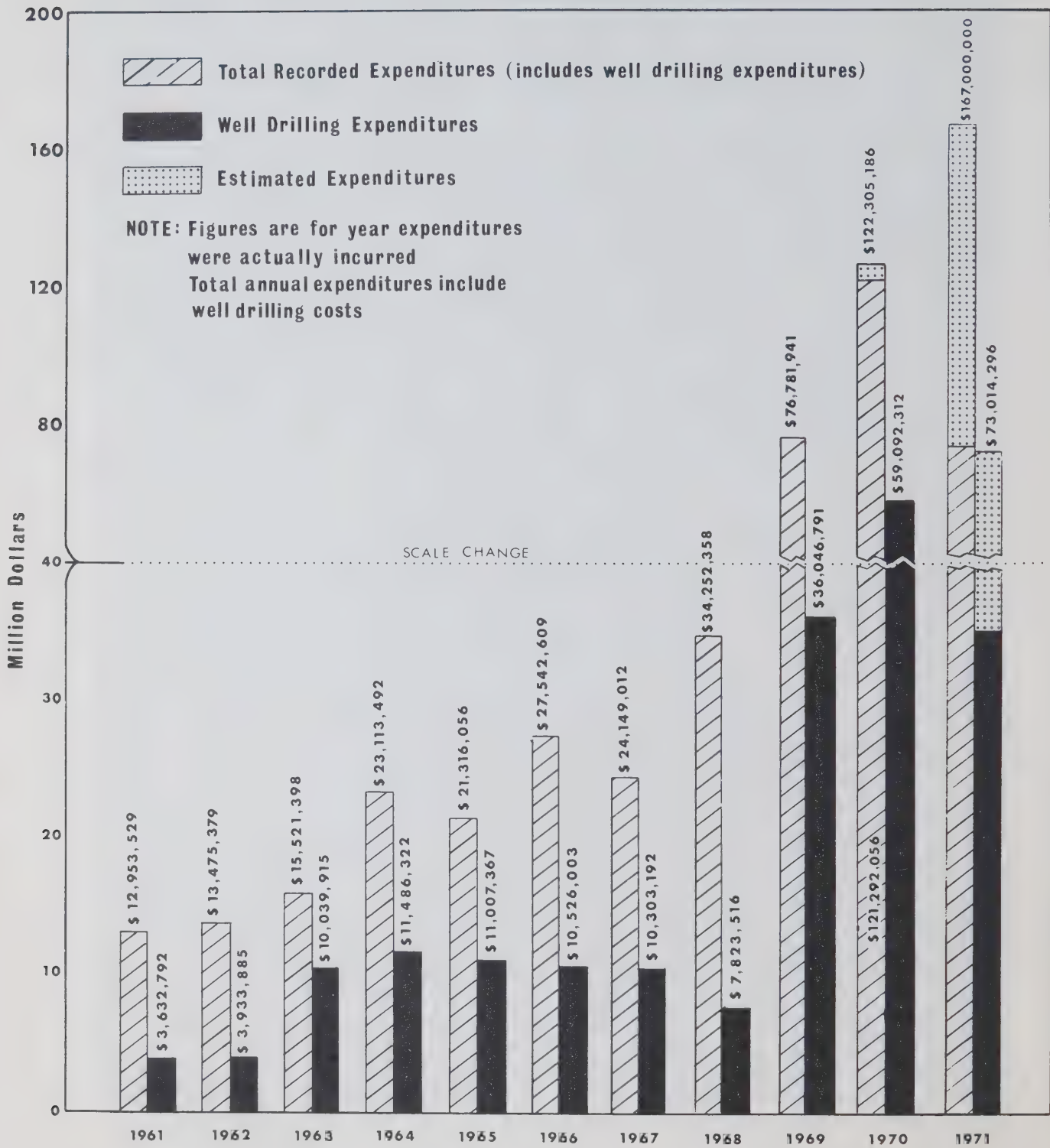
- 1) *Polarquest* is a 4 to 5 year program of reconnaissance surveys in the Arctic and surrounding waters. Programs in 1971 consisted of regional geology, aeromagnetic, gravity, environmental studies, and a collection of bathymetric data. These surveys will provide basic information and allow for detail planning by the permittees on their specific areas of interest. In 1972 Polarquest will undertake ten extensive marine seismic programs in the inter-island areas of the Eastern Sverdrup Basin and in the Parry Channel. In addition surface surveys will be undertaken in the Central Arctic Islands.
- 2) *Operation Baffinquest* is an integrated geophysical-geological reconnaissance survey to explore the oil and gas prospects of the Baffin Shelf, the area surrounding Baffin Bay, Davis Strait and North Labrador Sea. Baffinquest is a joint venture sponsored by Kenting Limited, and V. Zay Smith Associates Ltd. Kenting Limited carried out the regional marine reflection seismic program. The geology and bathymetric portion of the survey together with the integrating of the geophysical data with geology was handled by V. Zay Smith Associates Ltd. The geology will essentially consist of dredging samples from the Bay areas and carrying out detailed stratigraphic and paleontological investigations in Calgary.
- 3) *Sigma Seismic Programs* — Sigma Geophysical Limited carried out 2 large reconnaissance seismic programs, one was in the area between latitude 66° to 70° east of the MacKenzie River, the second program was centered between latitude 64° and 69° along the Mackenzie River and west of the River in the Delta. Information from these surveys is made available to all interested permittees and operators. The permittees acquiring this information by the purchase of data may apply their expenditures on permits encompassed by the area covered by the surveys.
- 4) *Phoenix Ventures Programs* — carried out two large land and marine seismic programs along the Arctic Coastal Plain, MacKenzie Bay and Beaufort Sea. Total cost of the programs are estimated to be 3.54 million dollars. Permittees acquiring this information by the purchase of data may apply their expenditures to permits in the general Mackenzie Bay, Beaufort Sea areas.
- 5) *Arctic Petroleum Operators Association*—The Association is composed of 24 oil companies who hold permits in the Beaufort Sea Area. The objectives are to develop the necessary operating technology for the Arctic to engage in studies related to ecological and conservation programs and to act as liaison between other research agencies relative to Arctic operations. Since its inception in January 1970, 16 APOA projects have been completed or are currently underway. The total cost of the projects is approximately 1.5 million dollars. Some of the major programs are preparing drilling guidelines for the Arctic and offshore areas; carrying out a feasibility study for a light-weight drilling rig specifically for the Arctic; assisting with an oil spill contingency plan and studying characteristics and movement of ice in the Beaufort Sea.



Photograph No. 2 Northern Transportation Company Camp at Tuktoyaktuk (Courtesy - Northern Transportation)

Fig. 7

OIL & GAS EXPLORATION EXPENDITURES





Photograph No. 3 — Barging supplies to Prudhoe Bay (Courtesy — Northern Transportation)

Fig. 8

EXPLORATION ACTIVITY

YUKON TERRITORY AND NORTHWEST TERRITORIES

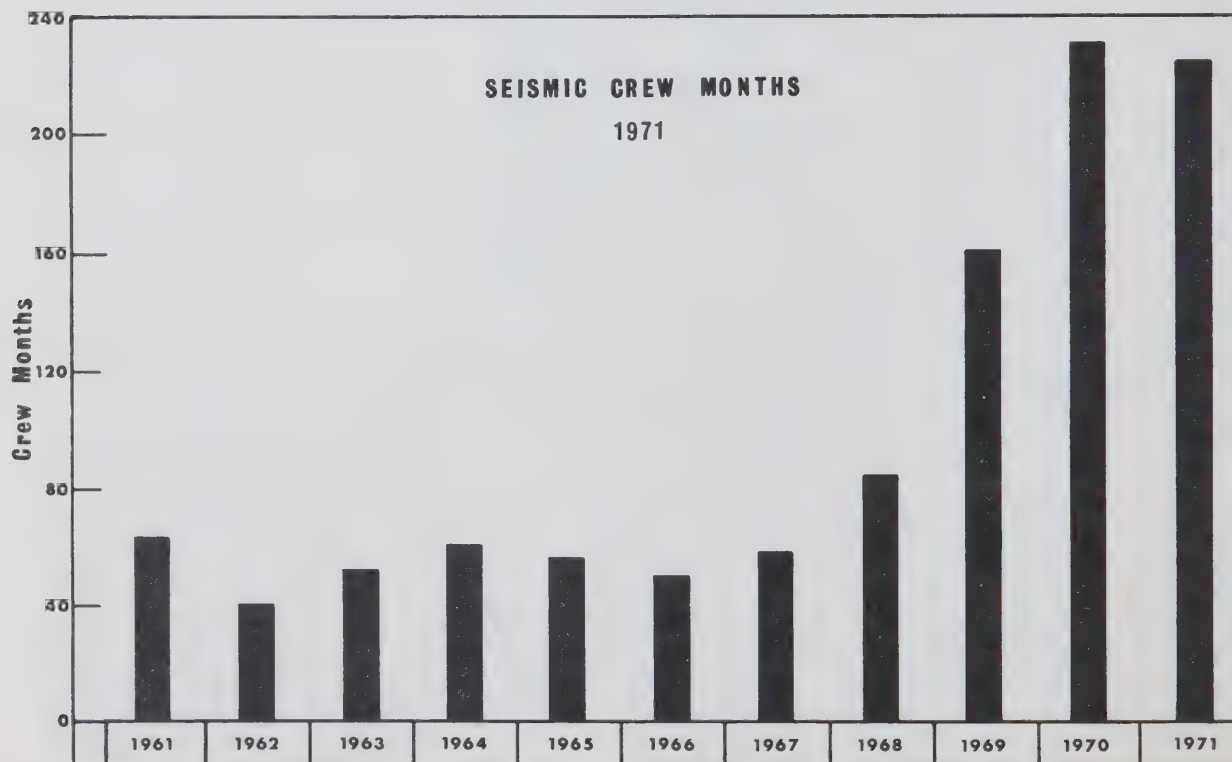
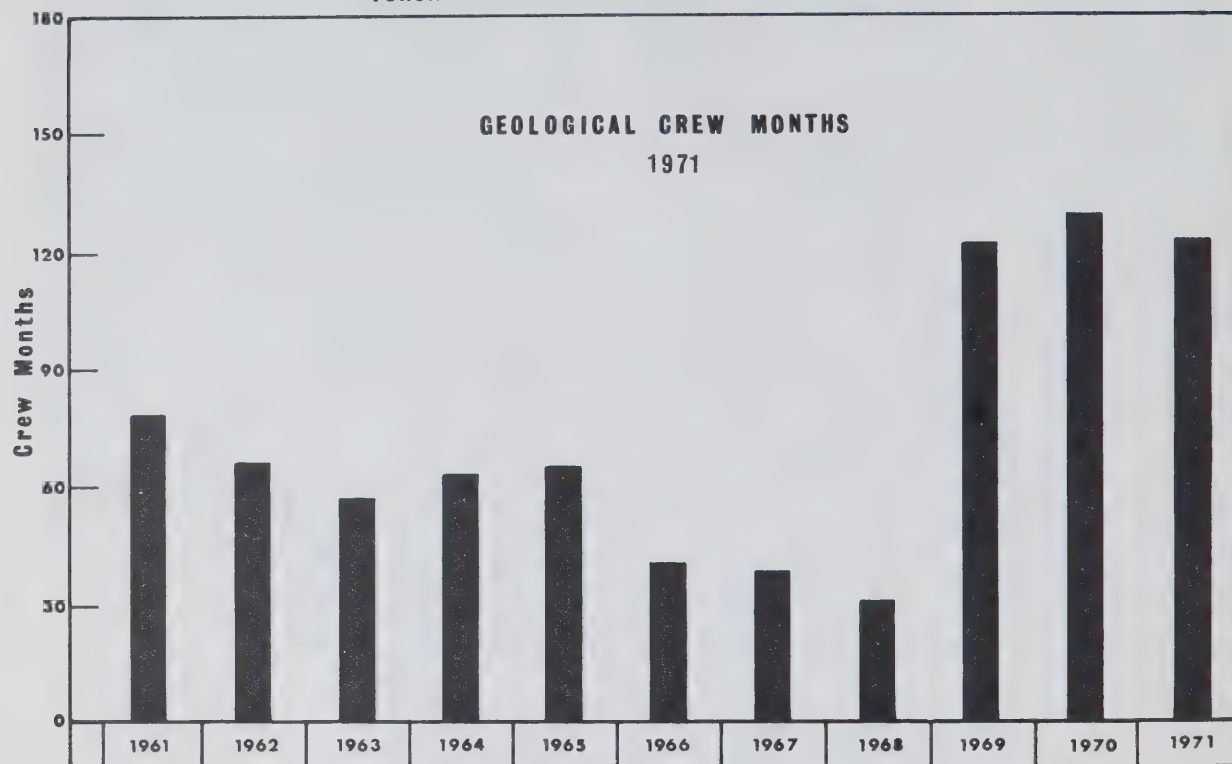


Fig. 9

WELLS DRILLED

YUKON TERRITORY - NORTHWEST TERRITORIES
Number of Wells Drilled to end 1971, 580

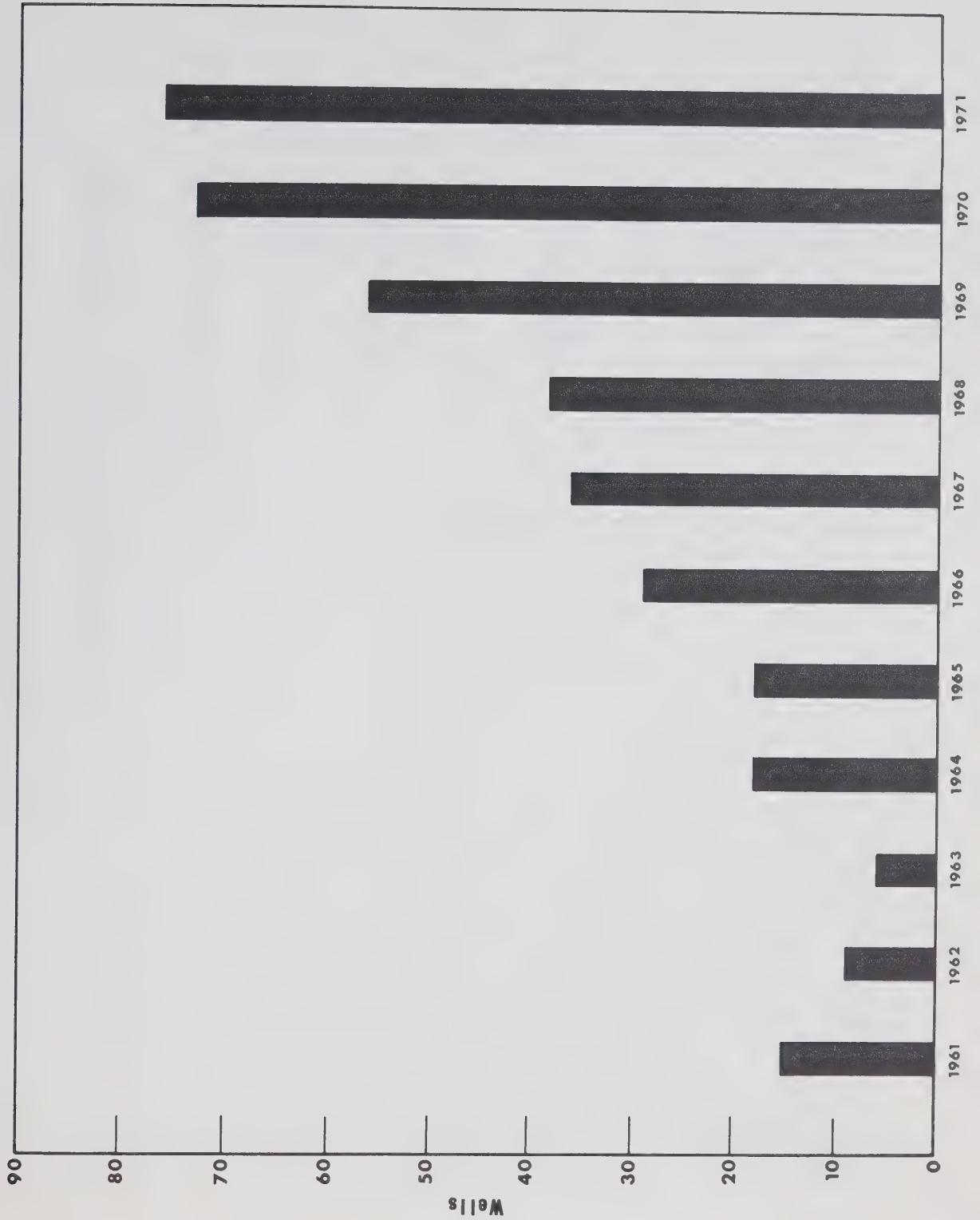
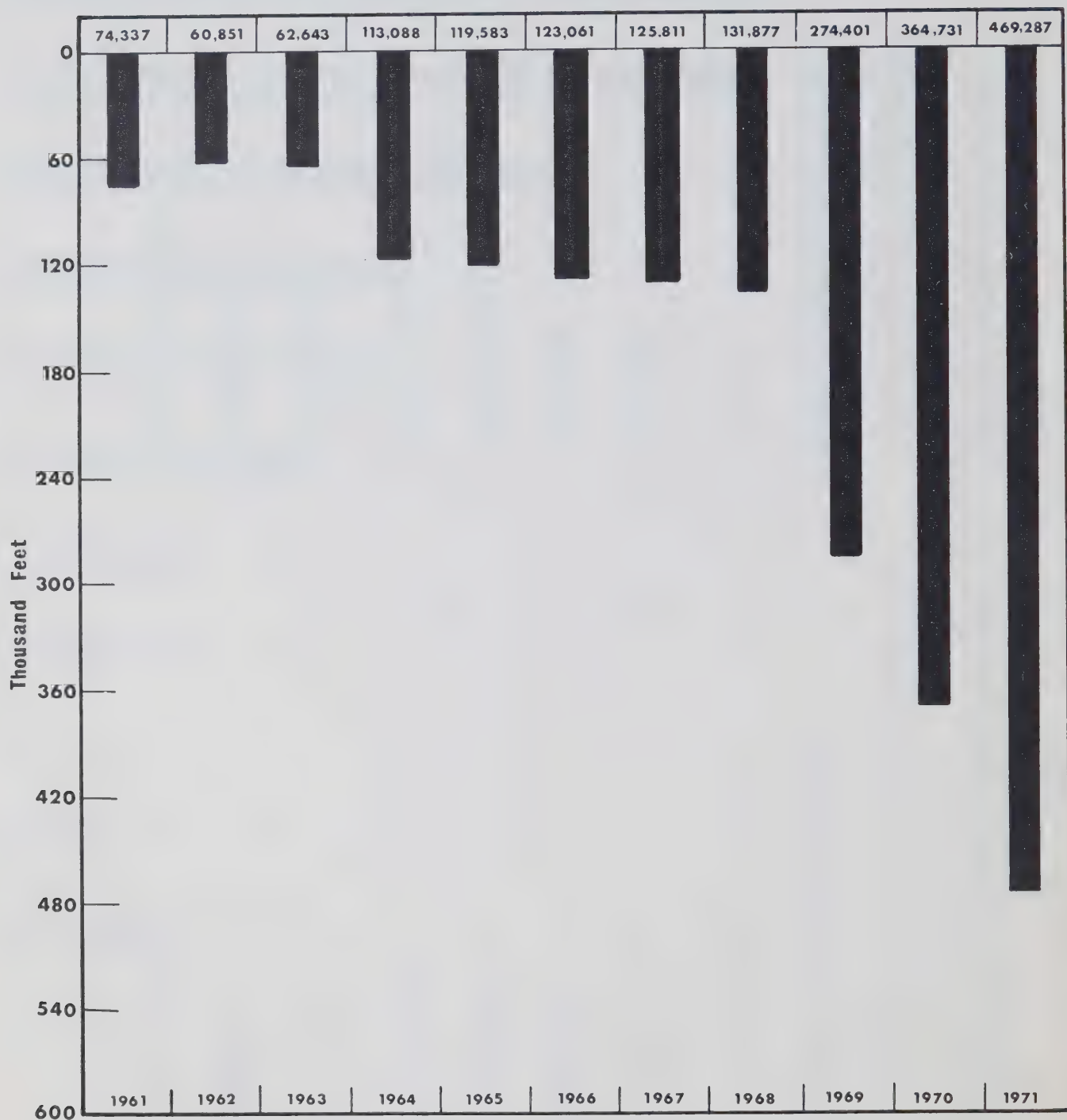
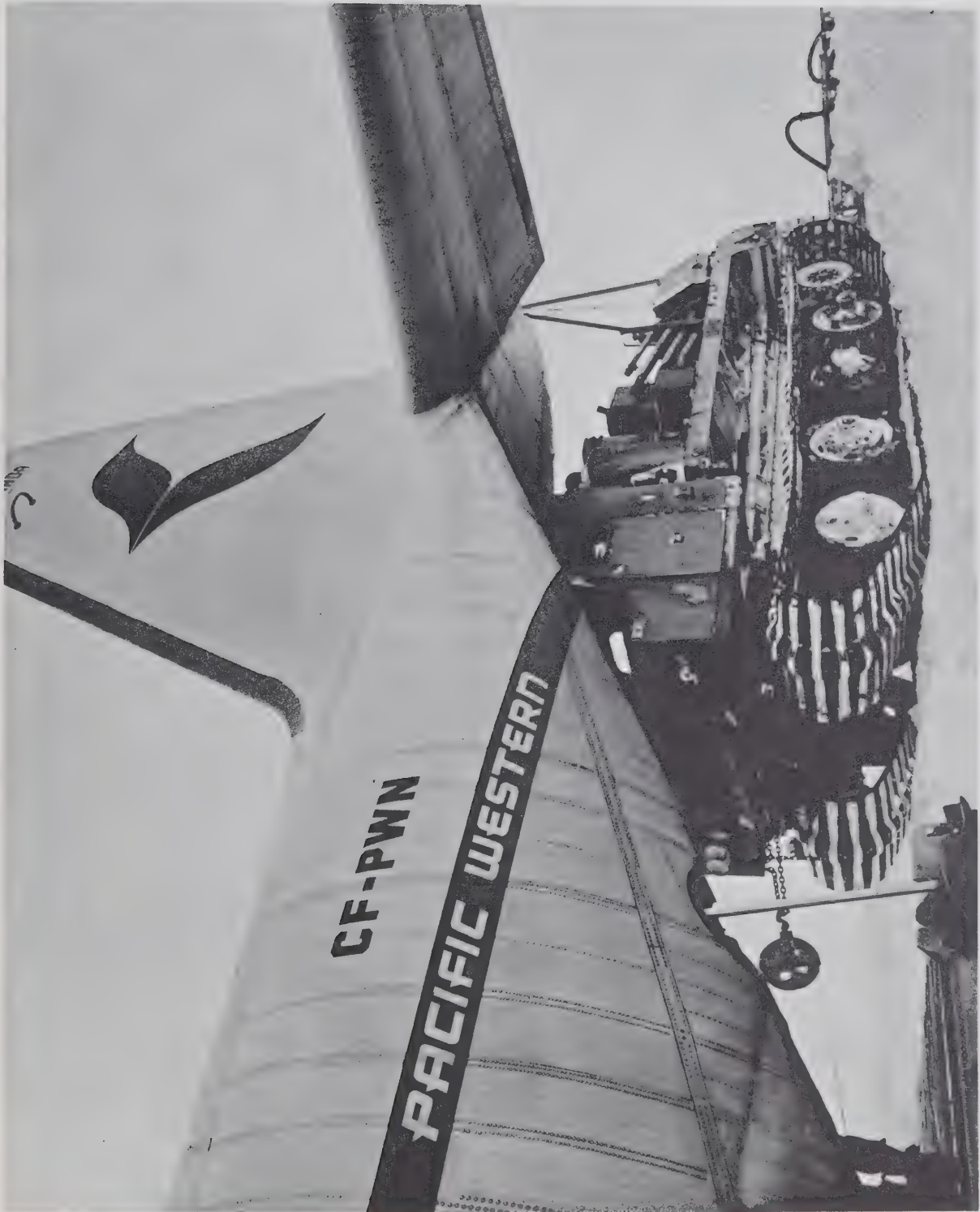


Fig. 10
FOOTAGE DRILLED
 YUKON TERRITORY AND NORTHWEST TERRITORIES





Photograph No. 4 — Transporting a seismic tracked vehicle by Hercules (Courtesy — Pacific Western Airlines)



Photograph No. 5 -- Panarctic Tenneco et al Kristoffer Bay G-06 on Ellef Ringnes Island (Courtesy -- Panarctic Oils)

EXPLORATION-ITEMS OF INTEREST

Oil and Gas Production and Conservation Act

The need for an Oil and Gas Production and Conservation Act to provide statutory authority for control of oil and gas production, prevention of waste and safety of operations in the North was recognized in the Oil and Gas Production and Conservation Act that became law on June 27, 1969. This Act, confined initially to the Yukon and Northwest Territories was extended to cover all of Canada outside of the provinces on June 11, 1970.

Regulations pursuant to this Act are in the final stages of drafting.

Gas Purchase Agreement

The Westcoast Transmission Company and Amoco Canada Limited signed a contract for dedication of the company's developed gas reserves in the Beaver River Field straddling the British Columbia — Yukon border and at Pointed Mountain Field in the southwest sector of the Northwest Territories.

The reserves proved and those developed in the Beaver River — Pointed Mountain area are needed by Westcoast Transmission to help in meeting additional market requirements expected over a 25-year period. A 24-inch gas pipeline extending north for 110 miles from the present terminus of Westcoast Pipeline Company at Fort Nelson to the Beaver River gas pool was completed in 1970. The gas dehydrator plant and a gas gathering system in the Beaver River Field went on stream in October, 1971. Initial gas deliveries from Beaver River may exceed 200 MMcf/d. A second contract for the construction of a gas dehydrator plant at Pointed Mountain and a connecting pipeline to Beaver River has been let. This section of the gas gathering facilities will be on stream by November 1, 1972.

When the development programs are completed it is likely that royalties from gas sales in the tri-corner of British Columbia, Yukon Territory and the Northwest Territories area will exceed one million dollars by 1975.

Land Use Regulations

In June, 1970, amendments to the Territorial Lands Act were passed by Parliament and these permit the implementation of Territorial Land Use Regulations. The Regulations were promulgated on November 4, 1971.

The regulations provide authority for designating Land Management Zones in the Yukon Territory and Northwest Territories. Within these zones all resource exploration and development operations will be required to take out Land Use permits. The Land Use permits will stipulate the required measures to be followed by the operator to protect and prevent unnecessary disturbance of the affected terrain and ecosystems.

The Land Use Regulations are being administered in the Northwest Territories by the Regional Director of Resources and his staff in Yellowknife; in the Yukon Territory the Regulations are administered by the Regional Director of Resources and his staff in Whitehorse. Programs carried out on all offshore areas contiguous to the Northwest Territories are monitored by the Regional Director of Resources in Yellowknife.

Arctic Pipeline Research Projects

Over \$60 million has now been committed to studies aimed at preserving the environment of the areas which will be crossed by pipelines carrying oil and gas from the Arctic.



Photograph No. 6 — Panarctic Romulus C-42 on Ellesmere Island (Courtesy — Panarctic Oils)

Major contributors to this intense research effort are the Northwest Project Study Group, \$15 million; Mackenzie Valley Pipeline Research Ltd., \$15 million; the Canadian Government, \$20 million; Gas Arctic Systems, \$6 million, the Alyeska Pipe Line Service Co., an estimated \$5-6 million.

The major participants are:

1) *Mackenzie Valley Pipeline Research Ltd.*

Mackenzie Valley participants include Amoco Canada Petroleum Company Ltd., Ashland Oil Canada Limited, Atlantic Richfield Canada Limited, B.P. Oil Limited, Cities Service Company, Elf Oil Exploration and Production Canada Limited, Gulf Oil Canada Limited, Hudson's Bay Oil & Gas Company Limited, Imperial Oil Limited, Interprovincial Pipeline Company, Mobil Oil Canada Limited, Shell Canada Limited, Standard Oil Company of British Columbia Limited, Texaco Inc., Trans Mountain Oil Pipeline Company, and Transcanada Pipelines Limited.

The object of the Mackenzie Valley research was the evaluation of the methods of oil pipeline construction:

(1) pipe supported on pile bents (pile-supported construction)

and

(2) pipe supported on and covered by gravel (berm construction)

2) *Northwest Project Study Group* – members are Atlantic Richfield, Humble Oil & Refining Co., Standard Oil Co. (Ohio), TransCanada, Michigan Wisconsin Pipe Line Co., and Natural Gas Pipe Line Co. of America. Northwest Project Study Group is operating two programs on one site at Sans Sault Rapids, 65 miles northwest of Norman Wells, N.W.T.

3) *Gas Arctic Systems Study Group*

The Gas Arctic Systems Study Group is an organization formed of Canadian and U.S. gas and transportation companies with an interest in moving arctic gas to energy markets. The participants are: The Alberta Gas Trunk Line Company Limited, Canadian National Railway Company, the Columbian Gas System Inc. Northern Natural Gas Company and Texas Eastern Transmission Corporation.

The Company has announced that a program of research into the problems of laying a pipeline across the channels between the Arctic Islands by the Gas Arctic Systems Study Group has been launched.

A party of scientists and pipeline specialists are already at work on the program, operating from a base camp at the west end of Vanier Island.

Their immediate assignment is to gather data in the waters north of and adjacent to Bathurst Island, including information on ice types, ice thickness and ice movement. The group will also measure water depths and currents, chart the profile of the ocean floor, and examine the nature and thickness of the bottom sediments.

4) *The Mountain Pacific System* – is sponsored by Westcoast Transmission Company Limited, Canadian Bechtel Limited, El Paso Natural Gas Company, Southern California Edison Company, and Pacific Lighting Corporation. This project is based on the concept by which a 48 inch pipeline would tap the major gas reserves in northern Alaska and the north Canadian mainland, and extend southward to serve the United States Pacific coast markets.

Pipeline Guidelines for Northern Canada

Canadian government guidelines for construction and operation of northern gas pipelines were announced jointly on August 13, 1970 by the Honourable Jean Chrétien, Minister of Indian Affairs and Northern Development, and the Honourable J.J. Greene, Minister of Energy, Mines and Resources.



Photograph No. 7 – Drilling Fosheim N-27 on Ellesmere Island (Courtesy – Panarctic Oils)

The guidelines relate to pipelines tapping oil and gas resources North of the 60th degree of latitude in the Yukon Territory and the Northwest Territories and from Alaska. They establish requirements ranging from environmental protection, pollution control and Canadian ownership and participation, to training and employment of residents of the north. Initially, only one trunk line each for oil and gas will be permitted in the north within a "corridor" to be established at a future date.

On June 28, 1972, the Government set out additional guidelines it expects applicants to follow. The guides involved a transportation corridor which would include both gas and oil pipelines, and an all-weather road to the Arctic Ocean along with power and communication lines. They are required "to minimize environmental and social disturbances and to ensure maximum benefits to Northern residents and communities."

Environmental Studies by Northwest Project Study Group

One of the largest industry-financed environmental research programs ever undertaken is being conducted as part of studies for a proposed natural gas pipeline from Alaska and northwest Canada. The Northwest Project Study group Calgary, Alberta, is spending over \$4.0 million on wildlife and vegetation studies, mostly in northwest Canada but also in northern Alaska.

The environmental research is part of a \$16 million feasibility study by the six-member group for a proposed 2,400 mile natural gas pipeline from Prudhoe Bay on the Alaskan north slope, across Canada to the U.S. midwest. The purpose of the environmental research is to ensure that construction and operation of the system will be planned so as to avoid impairment of the natural environment and wildlife resources of the north.

Field researchers last year compiled extensive baseline data such as populations, migration patterns, habitats, and other characteristics of wildlife resources in the Mackenzie Valley region, northern Yukon and northern Alaska. Included were extensive data on birds, fish, caribou, grizzly bear, Dall sheep, fox, muskrat, and other species. Five field parties with a total of 15 biologists and their technical assistants were engaged in the studies last year.

Panarctic to receive advance payment for gas

Panarctic Oils Ltd. will receive \$75 million from four U.S. companies to expand its exploration program in the Arctic.

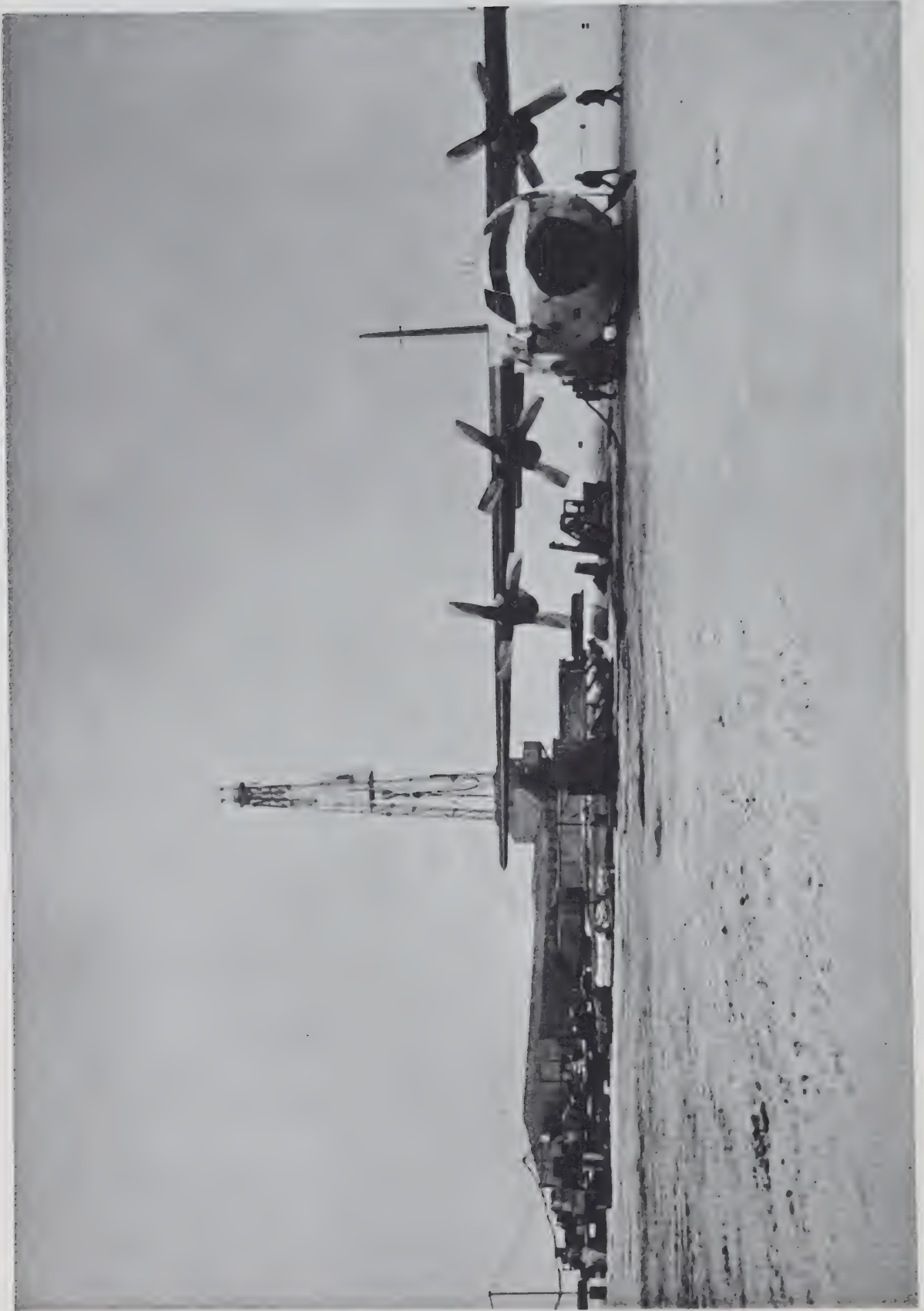
The money will be spent over a five-year period. Half of it comes from Tenneco Oil and Minerals Ltd., affiliated with the Tennessee Gas Pipeline system. The remainder will come from Columbia Gas Systems Inc., Texas Eastern Transmission Corp. and Northern Natural Gas Co. The agreement also allows for additional contributions.

In return for exploration capital, the four utilities will have priority in negotiating the purchase of any gas developed which is regarded as surplus to Canadian needs. Surplus amounts will have to be determined by the National Energy Board.

Imperial Oil Will Sell Delta Gas to U.S. Firms

Imperial Oil Limited reached an agreement with two companies based in the United States for the sale of up to 10 trillion cubic feet of natural gas from its property in the Mackenzie Delta area of the Northwest Territories.

Under the agreement, the two companies, Michigan-Wisconsin Pipelines Company and Natural Gas Pipeline Company of America, will jointly advance a total of \$40 million at the rate of \$10 million a year to Imperial Oil for "development and production of discovered and undiscovered natural gas reserves."



Photograph No. 8 — Hauling Fuel with Hercules (Courtesy — Panarctic Oils)

Imperial Oil said repayment for gas purchases by the two companies will be made in stages when approvals and permits have been granted and when gas begins to flow from the Delta to the appropriate markets.

The agreement covers natural gas reserves up to a maximum of 10 trillion cubic feet which may be discovered on Imperial's wholly-owned acreage in the Mackenzie Delta.

The sale, however, is subject to approval by regulatory bodies in both Canada and U.S.

Imperial building platforms in the Mackenzie Delta

Imperial plans to build two drilling platforms offshore in the Mackenzie Delta during the summer of 1972. Tentative sites selected by Imperial are IOE Kamotik (69° 42' – 134° 18'), and IOE Immerk (69° 36' – 135° 08'). The cost of construction is estimated at \$2 million each, work to commence in August, 1972.

The structures to be 10 or 12 feet above water surface will be left idle for one full winter before drilling operations begin in the winter of 1973-74. Seismic and testing equipment will be left on the artificial island to record weather and water parameters. The dredging equipment will be built and operated by Northern Construction Company of Vancouver.

Polarquest Programs for 1972

Kenquest Exploration of Calgary announced large exploration surveys for 1972 to consist of geological surveys, gravity programs, reflection seismograph surveys, Arctic Ice Studies and additional work in Baffin Bay. Specifically Polarquest '72 proposals are as follows:

- (a) Geological surveys, comprehensive stratigraphic mapping programs to include measured sections and stratigraphic maps.
- (b) Gravity Surveys – to be carried out on Melville and Ellef Ringnes Island, northeast Sverdrup Basin, Eureka Sound and Banks Island.
- (c) Marine Seismic Surveys – the ships Theron and Theta will again be chartered to enlarge on the 1971 seismic operations.
- (d) Arctic Ice Study – to consist of detailed field work centered around the Cornwall – Ellef Ringnes area. Surveys to consist of ice movement, water currents, bottom soil sampling and meteorological data.

Baffinquest '72

– to involve an integrated field geologic and marine bottom sampling survey and reconnaissance seismic surveys in Baffin Bay and Davis Strait.

Imperial Oil predicts large oil and gas development in the Beaufort Area.

Some 2 billion bbl of recoverable crude oil will have to be found in the Beaufort Basin in the Canadian Arctic to justify economic development. That is based on current prices for crude oil in the prime market area for such oil in U.S. Midwest.

Imperial's approach to analysis of a basin's potential uses what a senior official called "threshold volume". He described it as "the minimum reserve necessary to provide a rate of return judged to be adequate by the company risking the money".

He feels this term is more meaningful than estimates of ultimate potential hydrocarbon reserves, because it can be established with some degree of certainty during early exploration.

During the exploration stage, the threshold volume must be risk-adjusted to compensate for possible failure. Then if hydrocarbons are found, the figure is re-estimated.

At this point, the question is: "Regardless of how much has been spent to date, can the company incrementally afford to go ahead with further exploration to develop the discovered reserves?"

Oil or gas reserves must "stand on their own". This means the use of a possible Prudhoe Bay-to-Chicago pipeline is not assumed.

A 5-trillion-cu-ft gas reserve requires a 24-in. pipeline and a 15-trillion reserve calls for a 42-in. line.

A 750-million bbl oil reserve requires a 24-in. pipeline and a 5-billion reserve would need a 42-in. line.

Development and operating costs necessitate per-well producing rates more than 10 times the average Alberta MER.

Threshold level assumes recouping development and transportation investments; a no-risk return; and payment of operating costs, taxes, and royalty.

The threshold level assumes no return on past or future exploration/delineation investments.

Revenues

While no sales of oil and gas rights were held in 1971 revenues governing the Northern operations during the calendar year approximated \$5.8 million. (See Table 5 and Figure 12). Revenues from all sources for the fiscal year are shown in Table No. 4 and Figure No. 11. Figure 13 depicts the annual value of work bonus for oil and gas work bonus blocks and permits. Cumulative value of work bonus to the end of 1971 is approximately 59 million dollars.

TABLE 4

NORTHWEST TERRITORIES

(By Fiscal Year)

Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	Total
1963-64	1,950.00	183,250.00	7,550.00	40.00	157,519.99	69,882.00	18,288.12	334,395.06	1,023.00	773,898.17
1964-65	1,250.00	551,500.00	7,125.00	30.00	99,977.08	51,258.00	42,822.74	97,911.25	874.00	852,748.07
1965-66	1,425.00	344,000.00	7,850.00	1,050.00	350,130.08	178,878.00	69,952.16	5,298,589.01	674.30	6,252,548.55
1966-67	1,525.00	167,463.15	14,425.00	250.00	500,861.08	213,571.00	94,234.84	687,021.89	925.50	1,680,277.46
1967-68	2,148.18	112,000.00	7,465.00	1,830.00	815,186.24	106,229.00	36,336.07	825,045.35	1,109.86	1,902,349.70
1968-69	2,675.00	932,750.00	49,715.00	1,090.00	1,576,734.76	35,092.00	374,468.96	5,574,369.85	1,966.60	8,548,862.17
1969-70	3,800.00	391,692.70	59,080.00	2,240.00	2,093,730.05	19,630.00	19,852.44		2,296.10	2,592,321.29
1970-71	5,800.00	101,508.60	60,921.52	1,450.00	3,396,332.82(2)	244,072.00	729,500.39		1,930.17	4,541,915.50
1971-72(1)	3,050.00	386,500.00	47,760.00	550.00	3,947,803.07(3)	301,562.00	476,328.66		1,636.71	5,164,740.44

YUKON TERRITORY

1963-64	---	23,500.00	---	30.00	6,610.00	---	---	383,461.21	---	413,601.21
1964-65	25.00	12,250.00	---	---	13,220.00	---	---	---	---	25,495.00
1965-66	---	---	---	---	13,220.00	---	6,529.89	---	---	19,749.89
1966-67	---	19,250.00	225.00	---	25,865.00	---	46,758.05	---	---	92,098.05
1967-68	---	9,750.00	---	70.00	11,888.25	---	139,834.86	23,526.71	---	185,069.82
1968-69	---	82,000.00	875.00	330.00	27,939.25	---	7,845.90	936,526.37	---	1,055,516.52
1969-70	---	10,250.00	---	---	30,749.50	---	---	---	---	40,999.50
1970-71	---	4,750.00	25.00	190.00	364,604.75	---	41,306.56	---	---	411,076.31
1971-72(1)	---	---	410.00	85.00	81,609.25(4)	7,234.36	---	---	---	89,338.61

GRAND TOTAL REVENUES

1963-64	1,187,499.38	1965-66	6,272,298.44	1967-68	2,087,419.52	1969-70	2,633,320.79
1964-65	878,243.07	1966-67	1,772,375.51	1968-69	9,604,378.69	1970-71	4,952,991.81
1971-72(1)	5,254,079.05						

(1) Fiscal year 1971-72 (11 months actual)

(2) PERMIT Renewals — Special Renewals (\$1,233,796.00)

(3) " " " (\$1,528,189.50)

(4) " " " (\$ 24,960.00)

TABLE 5
(By Calendar Year)

NORTHWEST TERRITORIES

Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	Total
1963	1,600.00	155,000.00	8,200.00	140.00	157,396.56	69,882.00	39,343.52	334,395.06	633.33	766,590.47
1964	1,275.00	459,500.00	5,750.00	---	83,603.58	51,258.00	1,944.05	95,306.73	398.75	699,036.11
1965	1,425.00	323,000.00	7,275.00	890.00	280,449.08	178,178.00	78,826.31	909,353.25	995.00	1,780,391.64
1966	1,425.00	310,463.15	13,150.00	420.00	682,500.74	213,571.00	90,410.40	5,079,885.17	878.80	6,185,716.60
1967	2,175.05	96,250.00	9,475.00	760.00	475,513.08	106,229.00	36,106.20	484,623.02	929.72	1,419,048.73
1968	2,298.18	652,800.00	32,780.00	1,830.00	1,405,916.76	35,092.00	394,254.08	2,871,080.66	1,702.07	5,397,753.75
1969	2,000.00	320,701.30	45,540.00	1,290.00	1,404,600.82	19,630.00	19,852.44	3,043,711.52	1,700.73	4,859,026.81
1970	5,175.00	141,250.00	56,350.00	1,960.00	3,315,524.09(2)	244,072.00	661,828.60	NIL	2,285.69	4,428,445.38
1971	4,900.00	395,500.00	55,806.52	1,130.00	4,070,722.82(3)	301,562.00	478,609.95	NIL	1,681.03	5,309,912.32

YUKON TERRITORY

1963	---	13,500.00	---	30.00	6,610.00	---	---	383,461.21	---	403,601.21
1964	---	16,750.00	---	---	13,220.00	---	---	---	---	29,970.00
1965	25.00	5,500.00	---	---	13,220.00	---	6,529.89	---	---	25,274.89
1966	---	13,000.00	225.00	225.00	25,865.00	---	41,156.00	---	---	80,246.00
1967	---	9,750.00	---	70.00	11,888.25	---	5,602.05	16,616.00	---	43,926.30
1968	---	86,750.00	875.00	330.00	27,939.25	---	147,680.76	248,615.66	---	512,190.67
1969	---	8,500.00	---	---	30,749.50	---	---	671,306.75	---	710,556.25
1970	---	1,750.00	---	140.00	182,448.00	---	29,349.60	---	---	213,687.60
1971	---	4,750.00	360.00	275.00	423,944.50(4)	4,660.40	41,506.56	NIL	---	475,496.46

GRAND TOTAL REVENUES

1963 -	1,170,191.68	1965	-	1,805,666.53	1967	-	1,462,975.03	1969	-	5,569,583.06
1964 -	729,006.11	1966	-	6,265,962.60	1968	-	5,909,944.42	1970	-	4,642,132.98
1971 -	5,785,408.78									-

(1)

(2) PERMIT Rentals - Special Renewals (\$1,208,794.00)

(3) " " " (\$1,528,189.50)

(4) " " " (\$ 24,960.00)

Fig. 11

YUKON TERRITORY-NORTHWEST TERRITORIES
GROSS REVENUE-OIL & GAS
FROM
CASH BONUS BIDS, FEES, FORFEITURES
ROYALTIES, RENTALS & SALE OF MAPS

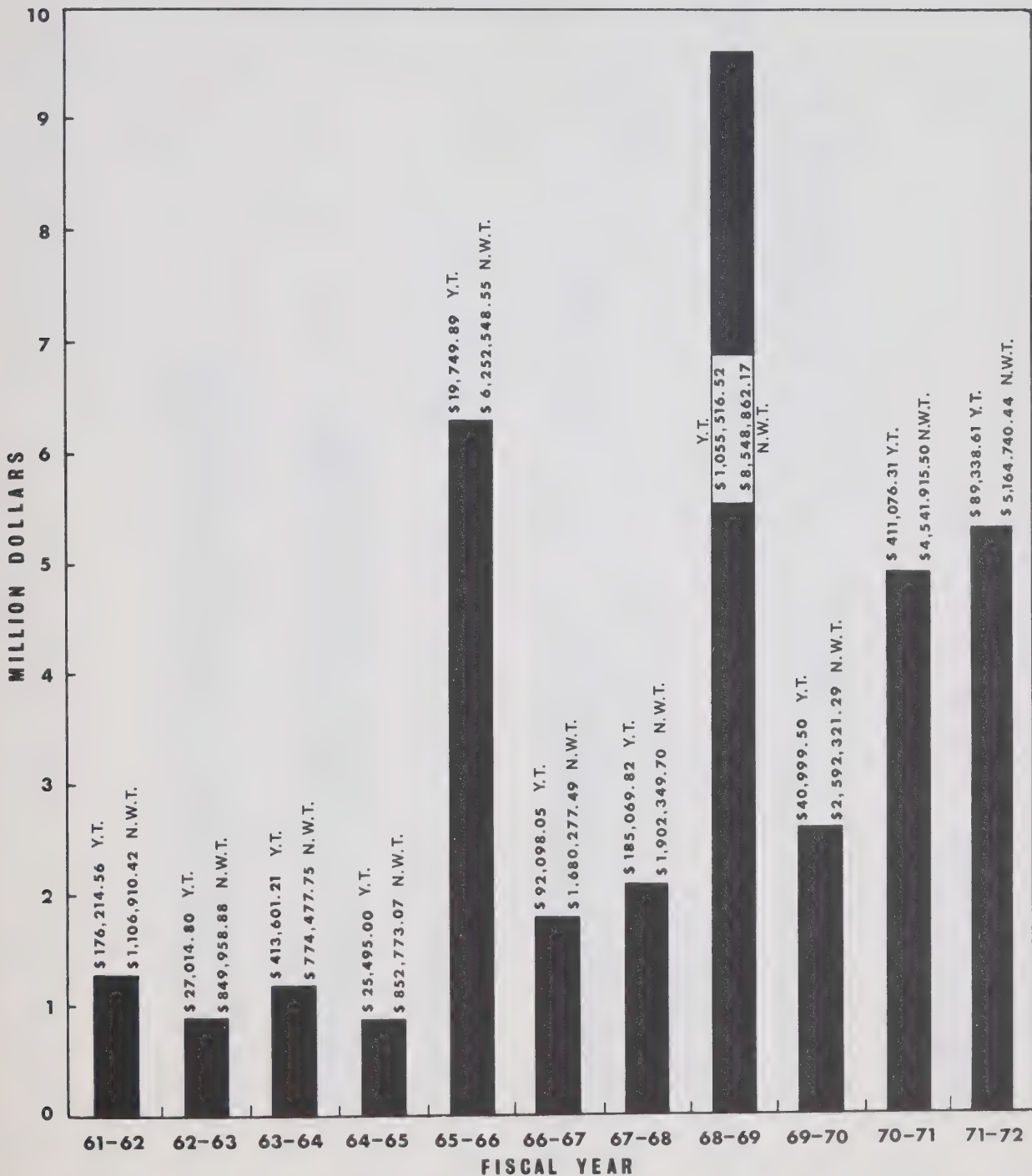


Fig. 12

YUKON TERRITORY - NORTHWEST TERRITORIES

GROSS REVENUE-OIL & GAS

FROM

CASH BONUS BIDS, FEES, FORFEITURES
ROYALTIES, RENTALS & SALE OF MAPS

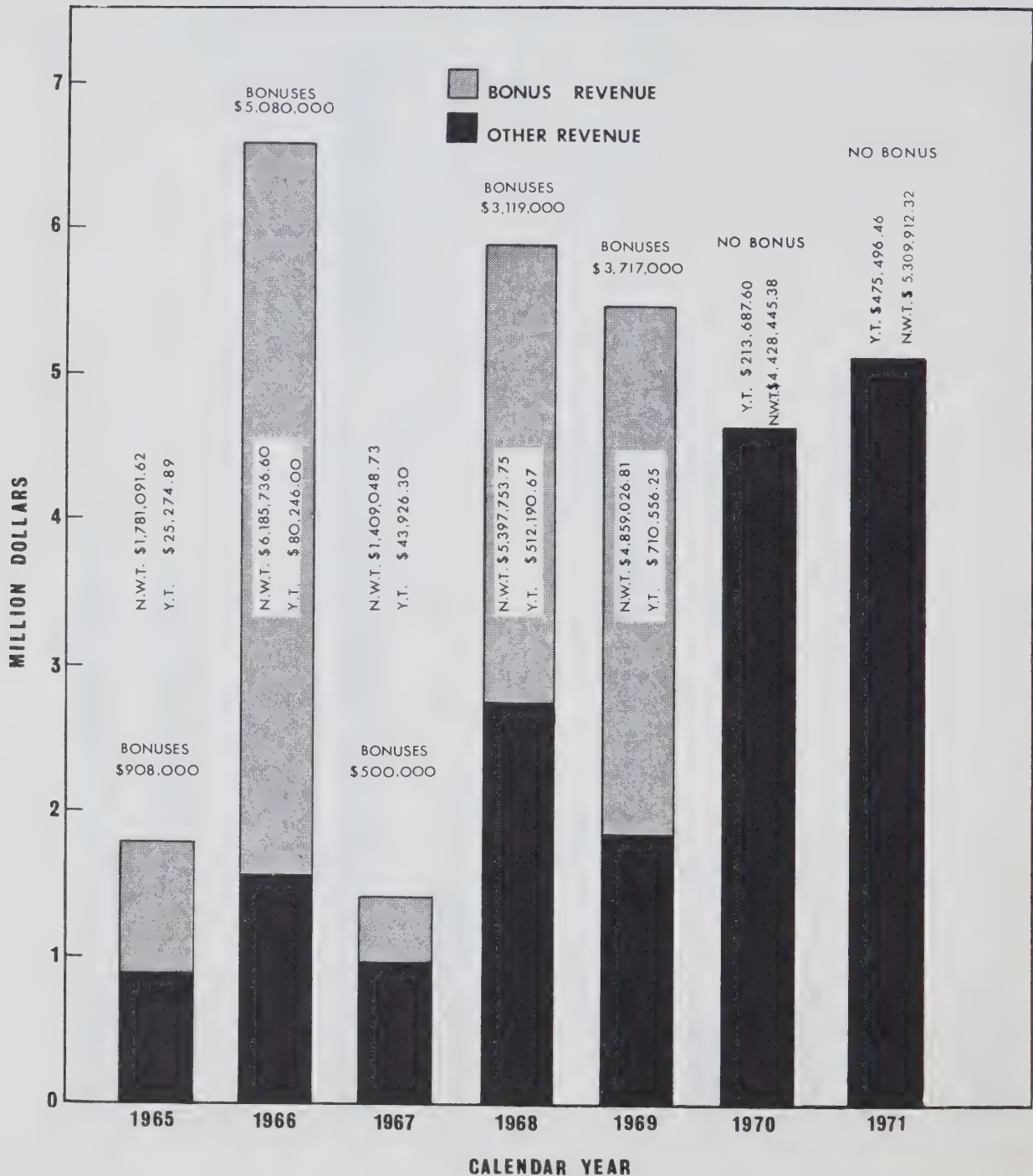
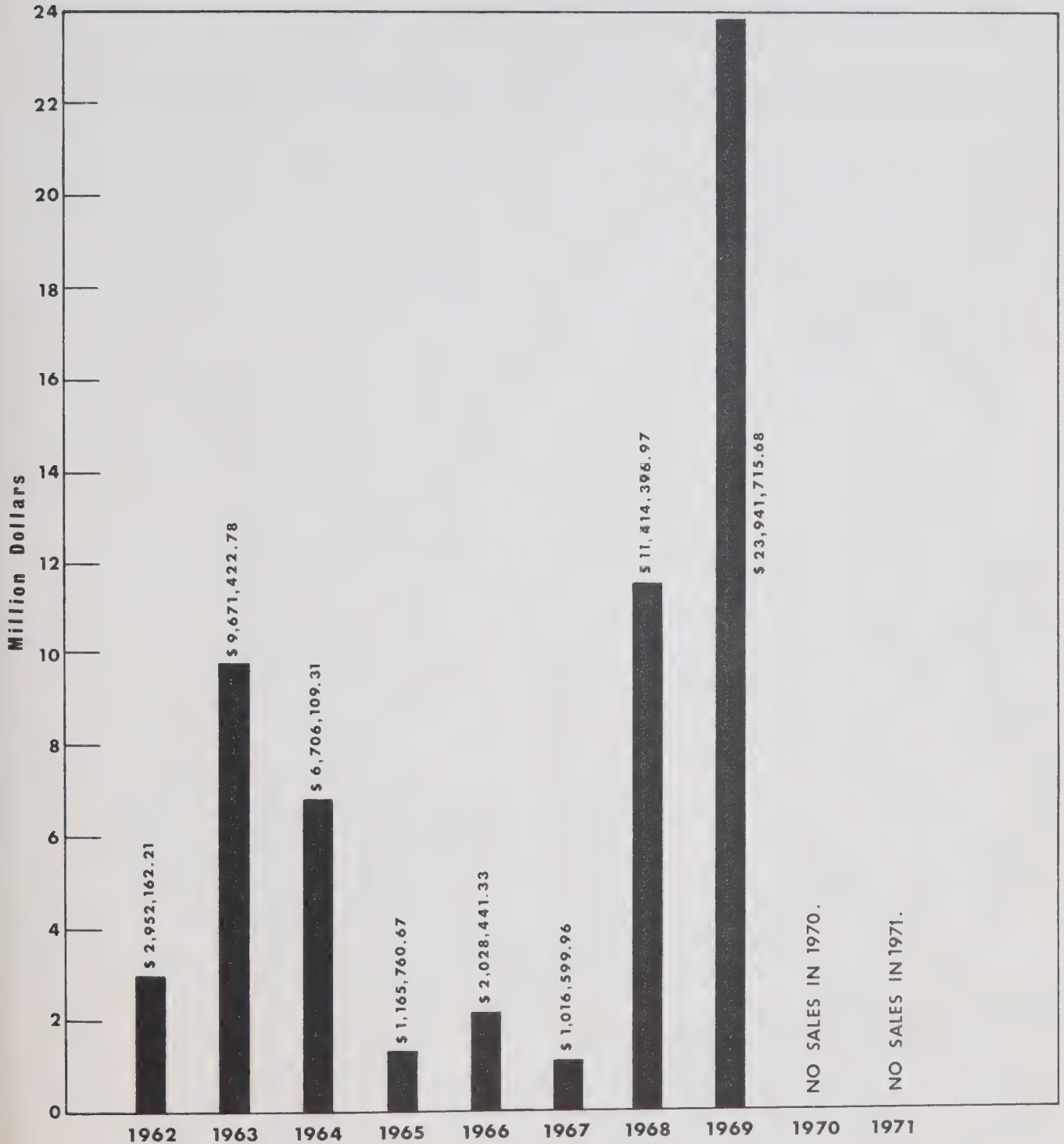


Fig. 13

VALUE OF WORK BONUS TENDERS—OIL & GAS
YUKON TERRITORY AND NORTHWEST TERRITORIES

NOTE: Cumulative Value End of Dec.1969

\$58,896,608.91



APPENDIX I

PUBLICATIONS

A. Maps

Many maps dealing with the northern resource activities are published by the Division and are available from the Oil and Gas Land and Exploration Section, Calgary, Alberta, or from the Chief, Oil and Mineral Division, Ottawa. The Oil and Mineral Division publishes a list of maps which may be obtained from either of the above sources.

B. The following reports may be obtained from Information Canada or the Oil and Gas Land and Exploration Section, Calgary. Pre-payment is required.

Schedule of Wells 1920-1960	— \$3.00
Schedule of Wells 1920-1961	— 4.00
Schedule of Wells 1920-1963	— 4.00
Schedule of Wells 1962-1964	— 2.00
Schedule of Wells 1965	— 3.00
Schedule of Wells 1966	— 3.00
Schedule of Wells 1967	— 2.50
Schedule of Wells 1968	— 2.50
Schedule of Wells 1969	— 2.50
Schedule of Wells 1970	— 2.50
Schedule of Wells 1921-1971	— in press (10.00)
Oil and Gas Statistical Report No. 1 (1920-1960)	— 2.50
Oil and Gas Statistical Report No. 2 (1961-1970)	— in preparation
“Technical Reports Available for Inspection 1972”. (Geological and Geophysical Reports released from confidential status are available for public inspection only in the office of the Oil and Gas Land and Exploration Section of this Department in Calgary).	— No charge

OTHER SOURCES OF INFORMATION

Information on northern resources activities can be obtained from the Chief, Oil and Mineral Division, Department of IAND, 400 Laurier Ave. West, Ottawa. All cores and samples from wells drilled on Canada lands are stored at the Institute of Petroleum and Sedimentary Geology, 3303-33rd St. N.W., Calgary 44, Alberta. Specialized and technical literature pertaining to Northern Canada can be purchased or perused at the following government agencies:

- (a) Northern Co-ordination Division Library, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa, Ontario.
- (b) Department of Energy, Mines and Resources

- 1. Geological Survey of Canada — Ottawa, Ontario and Vancouver, B.C.

Institute of Sedimentary and Petroleum Geology — Calgary, Alberta.

2. Marine Sciences Branch, Bedford Oceanography Institute – Dartmouth, N.S.
 3. Surveys and Mapping Branch – Ottawa, Ontario.
- (c) Defence Research Board, Scientific Information Service – Ottawa.
- (d) Ministry of Transport
1. Marine Works Branch – Ottawa, Ontario
 2. Marine Operations Branch – Ottawa, Ontario
 3. Telecommunications and Electronics Branch – Edmonton, Alberta and Ottawa, Ontario
 4. Civil Aviation Branch – Winnipeg, Manitoba.
- (e) Arctic Institute of North America – Montreal, Quebec.
- (f) National Research Council – Ottawa, Ontario.
1. Dominion Observatories Branch – Ottawa, Ontario.
- (g) The following brochures published by this Department may be available in some Public Libraries:
- i Guide to Northern Non-Renewable Resources
 - ii Communication and Transportation Facilities Queen Elizabeth Group – Arctic Islands
 - iii Resource Management Division – Responsibilities and Administration
 - iv Oil and Gas Canada Lands – Volume No. 2
 - v Oil and Gas Canada Lands – Edition No. 3
 - vi Oil and Gas in the Yukon and Northwest Territories – Edition No. 4 – 1967
 - vii Oil and Gas – North of 60 – 1968
 - viii Oil and Gas – North of 60 – 1969
 - ix Oil and Gas – North of 60 – 1970
 - x Prospectus – North of 60

INFORMATION AND PROCEDURES CONCERNING OPERATIONS ON CANADA LANDS

Certain federal agencies are concerned with exploration on Canada lands and must be notified prior to the commencement of any exploration activity. The operator or permittee – not the contractor, is responsible for providing the requisite advance notice of planned programs to these agencies by writing directly to them.

For offshore programs the Regional Director of Resources at Yellowknife, Northwest Territories, must be informed with respect to each program in addition to the Oil and Mineral Division. He will communicate with every department and agency on the need-to-know basis with respect to Marine Geophysical Programs. In the case of the Hudson Bay region, operators must also inform the National Research Council of proposed operations when under-taken during the summer months. Circumstances may be such that other agencies should be notified as well, and these are listed on the following pages, together with the names of persons who can be of assistance. For example, since operators are responsible for any damage they may cause to underwater commercial cables, it is recommended that they contact the Canadian Hydrographic Service for cable-lay data covering the area over which the work is to be performed. Similarly, the Customs and Excise Department should be contracted by the importing company if vessels or equipment are to be brought in from abroad.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

1. Pursuant to Section 52 of the Canada Oil and Gas Land Regulations, "Notice of Commencement of Exploratory Work" must be filed 15 days prior to commencement of proposed exploratory programs (geophysical, geological and research) on the Mainland in the Northwest Territories and Yukon Territory and Arctic Islands, and 45 days prior to commencement of geophysical work on offshore areas with the,

Oil and Gas Land and Exploration Section
Oil and Mineral Division,
Department of Indian Affairs and
Northern Development
112 – 11th Avenue S.E.
Calgary, Alberta T2G 0X5
Phone: 403-264-0201

2. Drilling Authority and advice on drilling matters can be obtained from the District Conservation Engineer for the District. See Map No. 7 for description of District outlines.
3. Information and assistance may be obtained from:

Chief,
Oil & Mineral Division,
Northern Economic Development Branch,
Department of Indian Affairs and Northern Development,
400 Laurier Avenue West,
Ottawa, Ontario.

Name: Dr. H.W. Woodward,
Phone: 613-992-0223

4. Advice on exploratory programs and operational matters may be obtained from:

Operations Supervisor,
Oil and Mineral Division,
Northern Economic Development Branch,
Department of Indian Affairs and
Northern Development
Ottawa, Ontario.

Name: S.A. Kanik
Phone: 613-992-0921

5. A Land Use Permit must be acquired for every land use operation, this includes drilling operations. Information and advice on the Land Use Regulations and Land Use Permits can be obtained

For the Northwest Territories:

Regional Director of Resources,
P.O. Box 1500
Yellowknife, N.W.T.

Name: G.B. Armstrong,
Phone: 403-873-4421

For the Yukon Territory:

Regional Director of Resources,
Room 211,
Federal Building,
Whitehorse, Y.T.

Name: B.J. Trevor
Phone: 403-667-7861

DEPARTMENT OF THE ENVIRONMENT

Resource Development Branch

Advance notice of 90 days is required before the start of a marine seismic survey involving the use of high explosives, in the event that qualified observers are needed. Nominal advance notice of 15 days to the Regional Director is required before the start of a seismic survey in which a source of accoustical energy other than high explosives is to be used.

Written notices should be sent to the appropriate Regional Director of Fisheries with a copy to:

Assistant Deputy Minister
Environmental Protection Service
Department of the Environment
Fontaine Building
Hull, Quebec

Name: K.C. Lucas
Phone: 613-997-8041

Information regarding the Department's requirement can also be obtained from:

A/Director,
Resource Development Branch.

Name: E.W. Burrridge
Phone: 613-996-0701

The address of the Regional Director responsible for all fresh water lakes in the Northwest Territories is:

C. McEwan,
114 Gary Street,
Winnipeg 1, Manitoba

Phone: 204-946-8101

In the Yukon Territory is:

W.R. Hourston,
1155 Robson Street,
Vancouver 5, B.C.

Phone: 604-666-1671

Information concerning wildlife such as the locations of migratory bird sanctuaries and National Wildlife Areas may be obtained from:

Director,
Canadian Wildlife Service,
Department of The Environment,
400 Laurier Avenue West,
Ottawa, Ontario

Attention: N.G. Perret
Phone: 613-992-5305

ATMOSPHERIC ENVIRONMENT SERVICE

Requests for information and assistance on meteorological and sea-ice data, climatology, weather forecasting, meteorological instruments and research may be directed to:

Assistant Deputy Minister
Atmospheric Environment Service
Department of the Environment
4905 Dufferin Street
Toronto, Ontario.

Name: J.R.H. Noble
Phone: 416-667-4774

Information may also be obtained through the Meteorological Liaison Officer in Ottawa. This position is filled on a rotation basis and the name of the officer is subject to change. Inquiries in Ottawa may be directed to:

Liaison Meteorologist,
Department of the Environment,
Fontaine Building,
Hull, Quebec

Name: D.J. Wright
Phone: 613-996-0807

Marine Sciences Branch

In addition to providing the commercial-cable lay data, the Canadian Hydrographic Service publishes charts of Canadian coastal waters, and information concerning these may be obtained from:

Canadian Hydrographic Service,
Marine Sciences Branch.

Attention: W.J. Covey
Phone: 613-994-9155

Information concerning charts showing Canada's Territorial Sea and Fishing Zone Limits and related data may be obtained from:

Canadian Hydrographic Service,
Marine Sciences Branch.

Attention: E.J. Cooper
Phone: 613-994-5411

Information on physical oceanography may be obtained from:

Canadian Oceanographic Data Centre,
Marine Sciences Branch.

Attention: C.M. Cross
Phone: 613-992-3940

Information on tides may be obtained from:

Tides and Water Levels,
Marine Sciences Branch.

Attention: G.C. Dohler
Phone: 613-994-9122

Information on hydrographic surveys and control data in the western Arctic regions may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
512 Federal Building,
Victoria, British Columbia

Name: M. Bolton
Phone: 604-338-3188

Information on hydrographic surveys and control data in the eastern Arctic may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
Atlantic Oceanography Laboratory,
Bedford Institute,
Dartmouth, Nova Scotia.

Name: R.C. Melanson
Phone: 902-426-3497

DEPARTMENT OF NATIONAL DEFENCE

Maritime Commanders

The appropriate Office of Maritime Command will be advised on the need-to-know basis by the Regional Director of Resources of any exploration program proposed for the offshore.

Operations in Baffin Bay, and Arctic waters east of longitude 105° West are handled by the office of:

Commander Maritime Command,
Department of National Defence,
F.M.O. HMC Dockyard,
Halifax, Nova Scotia.

Operations in Arctic waters west of longitude 105° West are handled by the office of:

Maritime Commander (Pacific)
Department of National Defence,
F.M.O. HMC Dockyard,
Victoria, British Columbia

MINISTRY OF TRANSPORT

Aids to Navigation Division

At least 60 days notice is required by this Division before the commencement of any offshore exploration program, in order that appropriate local Notices to Shipping and national Notices to Mariners may be issued. These Notices are subsequently copied into related foreign publications. The Division also indicates the requirement for any aids to navigational devices that may be necessary for the program.

Advance notice of 90 days is required in any case where drilling involves the territorial sea, in order for approval to be granted under the Navigable Waters Protection Act.

All communications on these matters should be directed to:

Chief, Aids to Navigation,
Marine Works Branch,
Ministry of Transport,
Ottawa, Ontario.

Phone: 613-992-2736

In addition, there are a number of Departmental officers who may be contacted in the field should the need arise. Their titles and addresses are given below:

District Marine Agent,
Ministry of Transport,
P.O. Box 310, Uppertown,
Quebec 4, Quebec
(This office handles Hudson Bay)

District Manager,
Ministry of Transport,
P.O. Box 155,
Hay River, N.W.T.

Phone: 403-874-2331

Marine Operations Branch

This agency directs the operations of the Canadian Coast Guard which has major responsibilities in two areas of concern to offshore operations: support of shipping in ice-congested waters, and marine search and rescue.

If operations are being contemplated for areas where ice may be a problem and where ice-breaker or other support may be desired, there should be consultation with the Director of Marine Operations as long in advance as possible. This is particularly important in the case of Arctic and Hudson Bay operations where the planning of ice-breaker disposition is usually done six months in advance of the season.

Further information and assistance may be obtained from:

Director,
Marine Operations Branch,
Ministry of Transport,
Ottawa, Ontario.

Phone: 613-992-4209

Marine Regulations Branch

This Branch includes the Steamship Inspection Division and the Nautical and Pilotage Division. The responsibilities of the former Division include inspection and certification of vessels under the Canada Shipping Act, oil pollution by vessels, and safety, pilotage, marine accident investigation and inquiries, salvage, marine personnel and navigational safety matters. This last includes the establishment of restricted navigation areas and the routing of ships.

Further information and assistance may be obtained from:

Director,
Marine Regulations Branch,
Ministry of Transport,
Ottawa, Ontario

Name: R.R. Macquillivray
Phone: 613-992-8892

Information with regard to safety of life at sea and acceptable standards of seaworthiness may be referred to:

Chairman,
Board of Steamship Inspection,
Marine Regulations Branch,

Name: W.E. Harrison
Phone: 613-992-1312

DEPARTMENT OF COMMUNICATIONS

Telecommunications Regulation Branch

The responsibilities of this agency include the development of technical standards, the selection and coordination of radio frequencies, and the licensing of all classes of radio stations except broadcasting.

An operator contemplating the use of radio communications in his offshore activities should make application for licensing of any radio station in Canada or on board any Canadian vessel involved at least six weeks before the proposed in-service date of the communication facility. Details as to the licensing requirements and the necessary application forms may be obtained from the Regional Superintendent, Telecommunications Regulations Branch, Department of Communications:

Oil companies in Western Canada may contact:

Radio Superintendent,
Telecommunications Regulation Branch,
Department of Communications,
Federal Building,
Edmonton, Alberta.

Name: L.E. Nelson
Phone: 403-424-0251 (Extension 334)

If need be, the following persons in Ottawa may be contacted for assistance:

Director,
Telecommunications Regulation Branch,
Department of Communications,
Ottawa, Ontario.

Name: W.J. Wilson
Phone: 613-992-0840

Advice in determining communication requirements and the necessary applications for licence may also be obtained from:

Chief,
Radio Authorization and Enforcement Division,
Department of Communications,
Ottawa, Ontario.

Name: A.G.E. Argue
Phone: 613-992-3427

DEPARTMENT OF ENERGY, MINES AND RESOURCES

Surveys and Mapping Branch

Information on the systems, methods and equipment utilized in positioning and surveying with respect to exploration work may be subject to review by this agency. Moreover, legal surveys must be made in accordance with instructions of the Surveyor General.

Inquiries concerning surveying may be directed to:

Surveyor General,
Legal Surveys Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: R. Slessor
Phone: 613-994-9174

Information concerning coastal control surveys may be obtained from:

Geodetic Survey Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: C.E. Hoganson
Phone: 613-994-5079

When requesting control survey data, the enquiries should define the area involved by latitude and longitude. In the case of a large area, it is important to state priorities within the area to facilitate processing.

Resource Management and Conservation Branch

The Resource Management and Conservation Branch is responsible for the administration of the federal interests in the mineral resources off Canada's east and west seacoasts and in the Hudson Bay and Hudson Strait regions.

All correspondence should be addressed to:

Director,
Resource Management and Conservation Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: D.G. Crosby
Phone: 613-994-5065

Surveys and Mapping Branch

Air photographs covering all portions of Canada may be obtained from:

National Air Photo Library,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: G.H. Whitcher
Phone: 613-994-5433

Topographic maps, indices charts, atlases and numerous other map publications may be obtained from:

Map Distribution Office,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: G.A. Clemmer
Phone: 613-994-9663

Geological Survey of Canada

The Geological Survey of Canada carries out systematic geological and geophysical surveys in the sedimentary basins of Canada, including parts of the regions offshore from the east and west coasts, in Hudson Bay, and in the Arctic Islands.

Inquiries with regard to the operations and publications of the Geological Survey should be made to:

Director,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: Y.O. Fortier
Phone: 613-994-5817

or to:

Director,
Institute of Sedimentary and Petroleum Geology,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Calgary Alberta.

Name: D.J. McLaren
Phone: 403-284-0110

Polar Continental Shelf Project

The Polar Continental Shelf Project is a continuous investigation of the continental shelf fringing the Arctic coast of Canada, together with adjacent parts of the Arctic Ocean basin, the islands of the Canadian Arctic Archipelago and the waters between them, and other areas of special interest.

Inquiries regarding surveys and scientific studies in Arctic areas may be directed to:

Co-ordinator,
Polar Continental Shelf Project,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: E.F. Roots
Phone: 613-996-3388

NATIONAL RESEARCH COUNCIL

Space Research Facilities Branch

Operators planning offshore activities in the Hudson Bay region must inform the following agency of the National Research Council well in advance since rockets are fired on a year round basis from the Churchill Research Range:

Head,
Range Section,
Space Research Facilities Branch,
National Research Council.
Ottawa 7, Ontario.

Name: Z.R. Charko
Phone: 613-993-9385

Operators active in the Hudson Bay region are also required to co-ordinate their field activities with:

General Superintendent,
Churchill Research Range,
National Research Council.
Fort Churchill, Manitoba.

Name: T.W. McGrath
Phone: 204-956-3010

Rockets are also launched from time to time from the facilities at Resolute Bay, N.W.T. and operators with exploration work planned for this vicinity are urged to co-ordinate their activities with the National Research Council.

DEPARTMENT OF NATIONAL REVENUE

Customs and Excise

The Port Administration administers that portion of the Canada Shipping Act that relates to the coasting trade. In this connection, any company importing ships or specialized plant and equipment for exploration work on Canada's seacoasts may obtain information, assistance and such other contacts as may be necessary in Customs and Excise from:

Director,
Port Administration Division,
Customs and Excise,
Department of National Revenue,
Ottawa, Ontario.

Name: M.A. Gallup
Phone: 613-992-4952

DEPARTMENT OF MANPOWER AND IMMIGRATION

Canada Immigration Division

Inquiries should be directed to:

Department of Manpower and Immigration,
Home Services Branch,
Canada Immigration Division,
Admission Section,
Ottawa, Ontario.

Attention: Mr. G.E. White
Phone: 613-992-3305

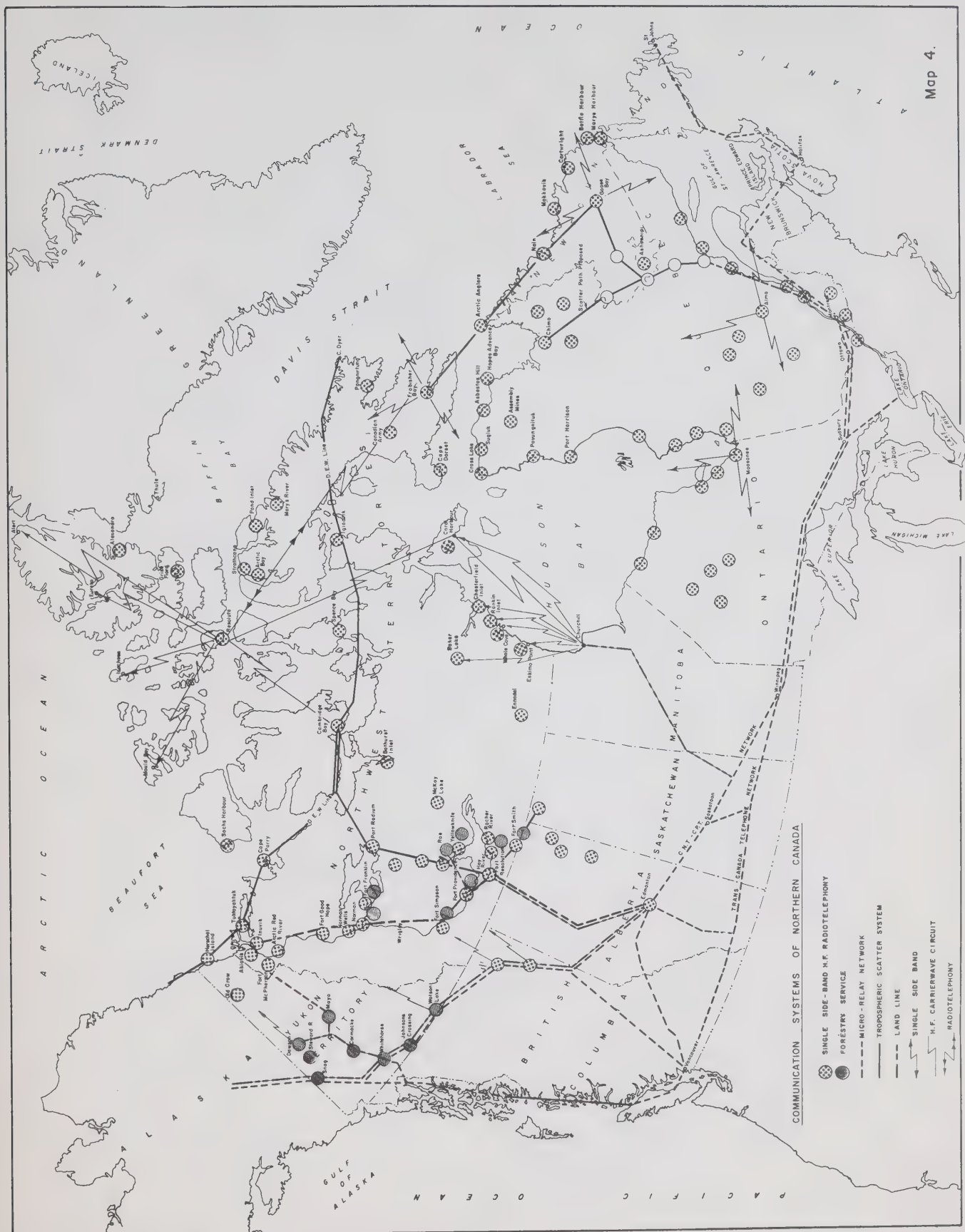
The Calgary and Edmonton offices of the Department of Manpower and Immigration can answer any queries regarding entry into the Northwest Territories. The Vancouver office can respond to queries for entry into the Yukon Territory.

At Tuktoyaktuk, a local R.C.M.P. officer is also a representative of the Department of Manpower and Immigration and can clear entry into Canada via Tuk.

At Inuvik, the Customs Department is also Departmental representative for Manpower and Immigration and can be contacted by telephone if prior arrangements are necessary. There is no representative at Aklavik; in the event that a seismic crew prefers to land at Aklavik, arrangements must be made with the Inuvik representative.

COMMUNICATIONS

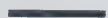

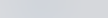



Information in the brochure "Communications and Transportation Facilities, Queen Elizabeth Group, Arctic Islands", is being updated and will be available in a comprehensive report entitled "Operational Guide for Oil and Gas Companies in the North". This publication is now in preparation and should be available by December, 1972. In addition to information concerning communication and transportation, the report will contain information covering all aspects of exploration in the North.



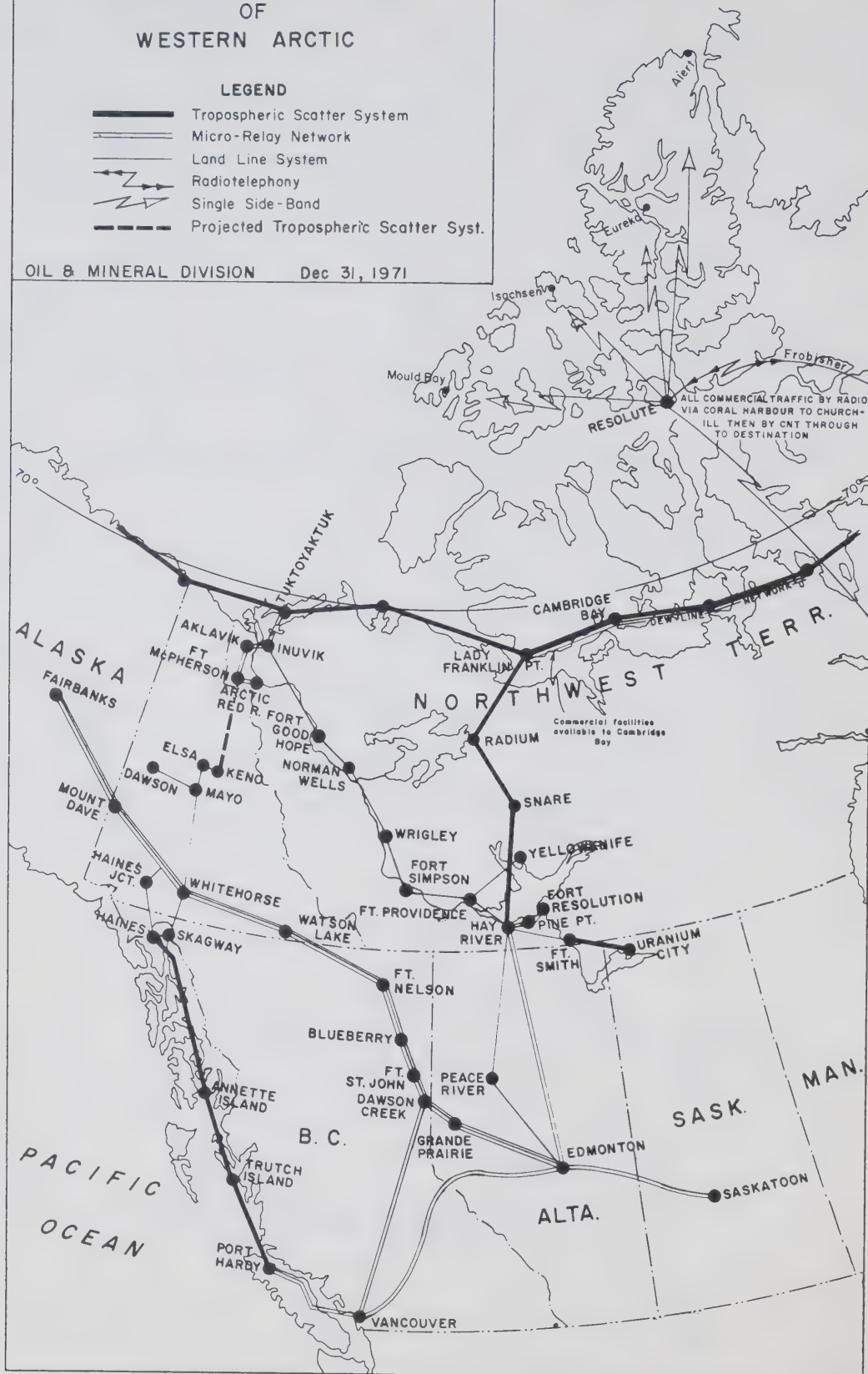
COMMUNICATION SYSTEMS OF WESTERN ARCTIC

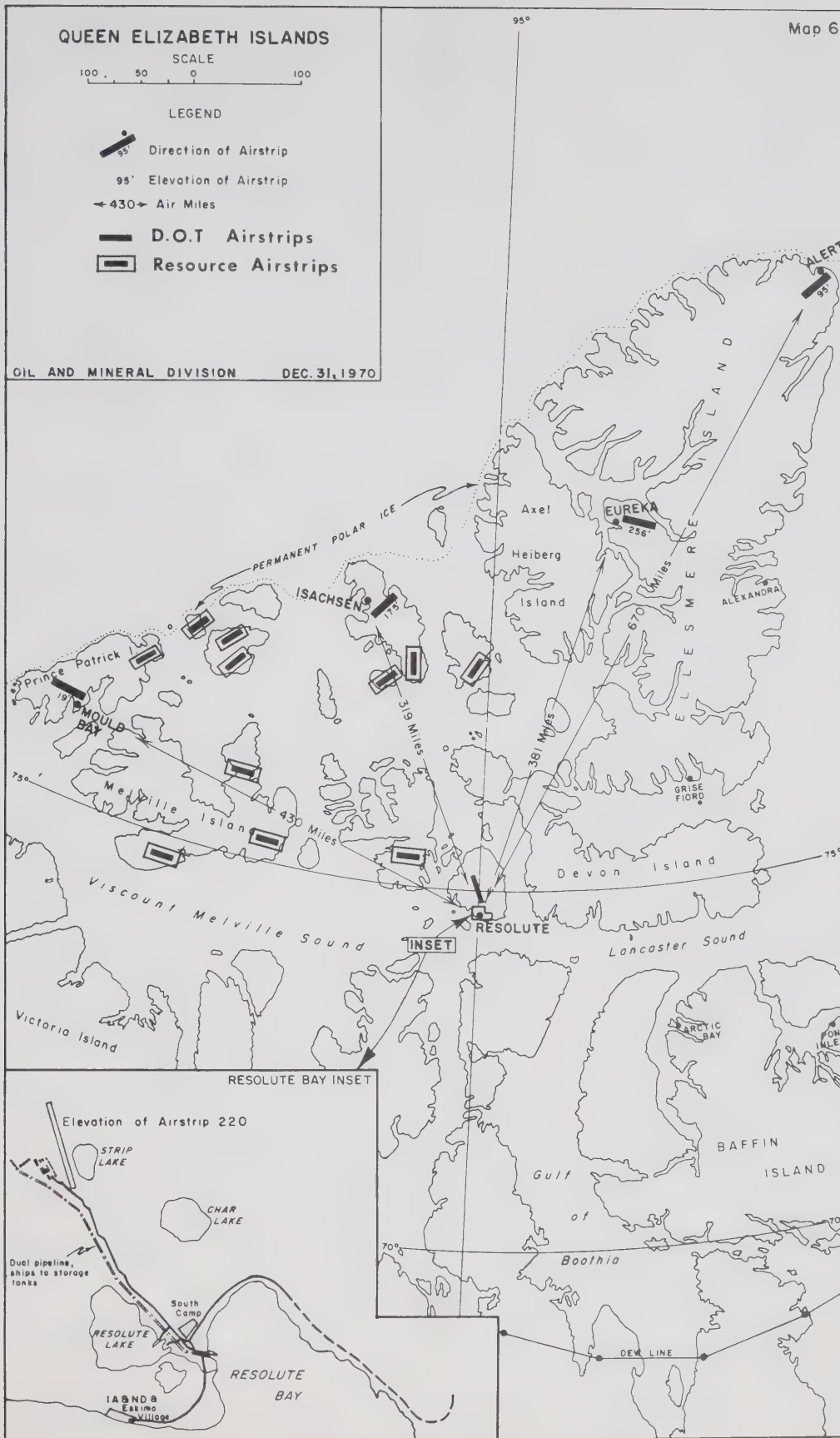
Map 5

LEGEND

-  Tropospheric Scatter System
-  Micro-Relay Network
-  Land Line System
-  Radiotelephony
-  Single Side-Band
-  Projected Tropospheric Scatter Syst.

OIL & MINERAL DIVISION Dec 31, 1971

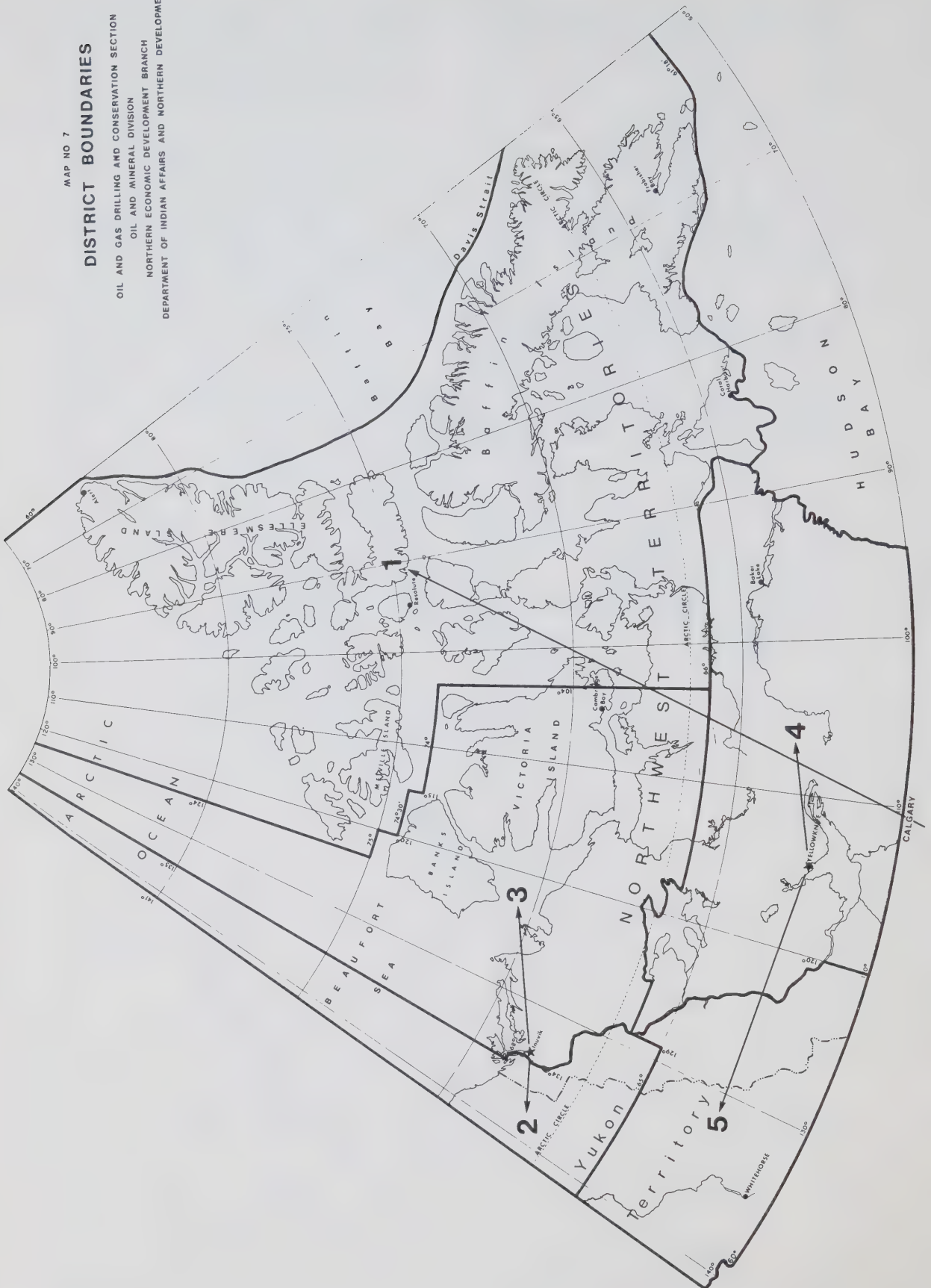




MAP NO 7

DISTRICT BOUNDARIES

OIL AND GAS DRILLING AND CONSERVATION SECTION
OIL AND MINERAL DIVISION
NORTHERN ECONOMIC DEVELOPMENT BRANCH
DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT



APPENDIX II

OIL AND GAS WELL DISCOVERIES

YUKON TERRITORY

Canada Southern et al N. Beaver R. Y. T. I-27 I-27-60-10-124-00	Suspended gas well September 29, 1964
Canoe River Chance Y.T. J-19 J-19-66-10-137-30	Suspended gas well February 17, 1968
Pan Am Beaver River Y.T. G-01 G-01-60-10-124-15	Gas well August 13, 1969
Socony Mobil et al Chance Y.T.G-08 G-08-66-10-137-30	Suspended oil well March 31, 1965
Socony Mobil et al Blackie No. 1 Y.T.M-59 M-59-66-00-137-00	Suspended gas well March 27, 1964
Socony Mobil et al Birch, Y.T.B-34 B-34-66-10-136-45	Suspended gas well June 8, 1965
Western Minerals Chance Y.T. No. 1 M-08 M-08-66-10-137-30	Suspended oil and gas well January 31, 1960

NORTHWEST TERRITORIES

Briggs Rabbit Lake No. 3 B-07 B-07-61-00-118-45	Suspended gas well March 9, 1957
Briggs Rabbit Lake No. 1 O-16 O-16-61-00-118-45	Suspended gas well March 17, 1955
CPOG et al LaBiche F-08 F-08-60-40-124-30	Suspended gas well March 19, 1971
Gulf Mobil Parsons F-09 F-09-69-00-133-30	Suspended gas well April 19, 1972
HB Cameron Hill A-05 A-05-60-10-117-30	Suspended gas well April 16, 1968
HB Pan Am S. Island R.M-41 M-41-60-10-121-00	Suspended gas well March 23, 1964
Home Signal Celibeta H-78 H-78-60-10-122-00	Suspended gas well March 13, 1960
IOE Atkinson H-25 H-25-69-50-131-45	Suspended oil well February 23, 1970
Imp IOE Mallik L-38 L-38-69-30-134-30	Abandoned gas well April 4, 1972

IOE Mayogiak J-17 J-17-69-30-132-45	Suspended oil well August 6, 1971
IOE Taglu G-33 G-33-69-30-134-45	Suspended gas well August 18, 1971
Imp IOE Taglu West P-03 P-03-69-30-135-00	Suspended gas well March 29, 1972
Pan Am Pointed Mountain O-46 O-46-60-30-123-45	Shut-in gas well October 2, 1971
Pan Am Pointed Mountain P-53 P-53-60-30-123-45	Shut-in gas well March 10, 1967
Pan Am Pointed Mountain K-45 K-45-60-30-123-45	Shut-in gas well May 8, 1968
Pan Am Pointed Mountain G-62 G-62-60-30-123-45	Shut-in gas well June 20, 1969
Shell HB Grumbler G-63 G-63-60-20-115-45	Abandoned gas well March 16, 1969
Sun Netla C-07 C-07-60-50-122-45	Suspended gas well April 5, 1961
Texaco Bovie Lake J-72 J-72-60-20-122-45	Suspended gas well April 20, 1966
Union Pan Am Trainor Lake C-39 C-39-60-20-120-30	Suspended gas well March 15, 1965
ARCTIC ISLANDS	
Panarctic Drake Point L-67 L-67-76-30-108-30	Suspended gas well February 26, 1970
Panarctic King Christian D-18-A D-18-77-50-101-00	Suspended gas well March 15, 1971
Panarctic Tenneco King Christian N-06 N-06-77-50-101-00	Suspended gas well October 8, 1971
Panarctic Tenneco et al Kristoffer Bay G-06 G-06-78-20-102-30	Suspended gas well March 17, 1972
Panarctic Tenneco et al Thor P-38 P-38-78-10-103-00	Suspended oil well May 10, 1972

APPENDIX III

WELLS ABANDONED OR COMPLETED IN 1971

NORTHWEST TERRITORIES – ARCTIC ISLANDS

NAME OF WELL	SPUDDED	COMPLETED	STATUS	TOTAL DEPTH
Aquitaine et al Rowley M-04	5-08-71	26-08-71	D & A	1,755
BP et al Hotspur J-20	6-04-71	14-12-71	D & A	12,584
Elf Jameson Bay C-31	11-03-71	16-05-71	D & A	8,327
Elf Wilkins E-60	11-10-70	25-01-71	D & A	11,140
Elf et al Storkerson Bay A-15	23-10-71	10-12-71	D & A	6,719
Panarctic Amund Central Dome H-40	10-11-70	25-04-71	D & A	11,030
Panarctic et al Corwallis Central Dome K-40	26-05-71	2-08-71	D & A	10,052
Panarctic Fosheim N-27	25-03-71	25-12-71	D & A	14,022
Panarctic Deminex Garnier O-21	23-04-71	9-07-71	D & A	6,515
Panarctic King Christian D-18A	26-11-70	15-03-71	Suspended gas well	2,779
Panarctic King Christian D-18	14-10-70	25-01-71	D & A	2,010
Panarctic Tenneco King Christian N-06	13-05-71	8-10-71	Shut-in gas well	11,020
Sun et al Kitson R. C-71	14-11-71	6-02-71	D & A	9,075
Sun et al Allison R. N-12	11-10-71	19-03-71	D & A	11,761
Sun KR et al Young Inlet D-21	10-05-71	12-07-71	D & A	6,058
Sun KR et al Skybattle Bay C-15	1-04-71	23-11-71	D & A	12,000

NORTHWEST TERRITORIES – MAINLAND

Atkinson CSP Trout Lake M-51	22-02-71	19-03-71	D & A	7,262
Atkinson Union Island River G-42	30-12-70	20-01-71	D & A	7,912
Atkinson et al Trainor Lake F-48	5-01-71	3-02-71	D & A	6,533
Banff et al Treeless Creek I-51	18-12-70	29-01-71	D & A	6,010
Buttes et al Blackwater Lake I-54	10-02-71	24-02-71	D & A	1,428
Buttes et al Blackwater Lake I-54A	7-03-71	3-04-71	D & A	4,515
Candel et al East Mackay B-45	7-02-71	19-03-71	Suspended	5,286
Candel et al Police Island L-66	12-03-71	6-04-71	D & A	4,414
Candex et al Dahadinni M-43A	2-02-71	04-09-71	D & A	10,272
CPOG et al LaBiche F-08	25-02-71	19-03-71	Suspended gas well	7,300
Cdn. Res. Signal Keller Lake 0-13	23-02-71	20-03-71	D & A	3,090
Cdn. Res. Signal Keller Lake F-49	25-03-71	1-04-71	D & A	711
Cdn. Res. Signal Keller Lake P-14	3-02-71	17-02-71	D & A	1,589
CDR Tenlen A-73	1-02-71	23-06-71	D & A	8,510
Decalta LRI et al Keele River I-01	3-12-70	9-01-71	D & A	5,600
Fina et al Willow Lake J-66	6-01-71	26-01-71	D & A	2,871
Fina et al Willow Lake L-59	2-02-71	26-02-71	D & A	2,750
Gobles et al Celibeta K-01	6-01-71	15-02-71	D & A	8,096

Gulf Mobil East Reindeer G-04	8-01-71	27-04-71	D & A	12,250
Gulf Mobil East Reindeer A-01	9-05-71	27-06-71	D & A	9,693
Horn River et al Antoine M-34	3-01-71	24-01-71	D & A	3,894
Horn River et al Berry Island A-42	12-02-71	12-03-71	D & A	6,000
Horn River et al Big Island O-78	13-01-71	23-01-71	D & A	1,803
Horn River et al Cli Lake M-05	13-01-71	13-02-71	D & A	6,500
Horn River et al Cormack C-65A	4-01-71	30-01-71	D & A	3,710
Horn River et al Deep Bay B-01	3-01-71	11-01-71	D & A	1,625
Horn River et al Deep Lake H-45	9-03-71	21-03-71	D & A	3,301
Horn River et al Ebbutt J-05	2-03-71	19-03-71	D & A	4,163
Horn River et al Green I. O-24	10-03-71	22-03-71	D & A	2,447
Horn River et al Kakisa N-73	28-03-71	7-04-71	D & A	2,800
Horn River et al Shell Levis D-76	10-02-71	19-02-71	D & A	1,463
Horn River et al Mink Lake I-38	25-01-71	8-02-71	D & A	1,362
Horn River et al Rabbit skin I-08	23-03-71	31-03-71	D & A	2,053
Horn River et al Trout D-66	22-02-71	7-03-71	D & A	2,265
Horn River et al Willowlake R. I-71	5-03-71	19-03-71	D & A	3,009
Horn River et al Willow Lake G-47	15-03-71	7-04-71	D & A	4,300

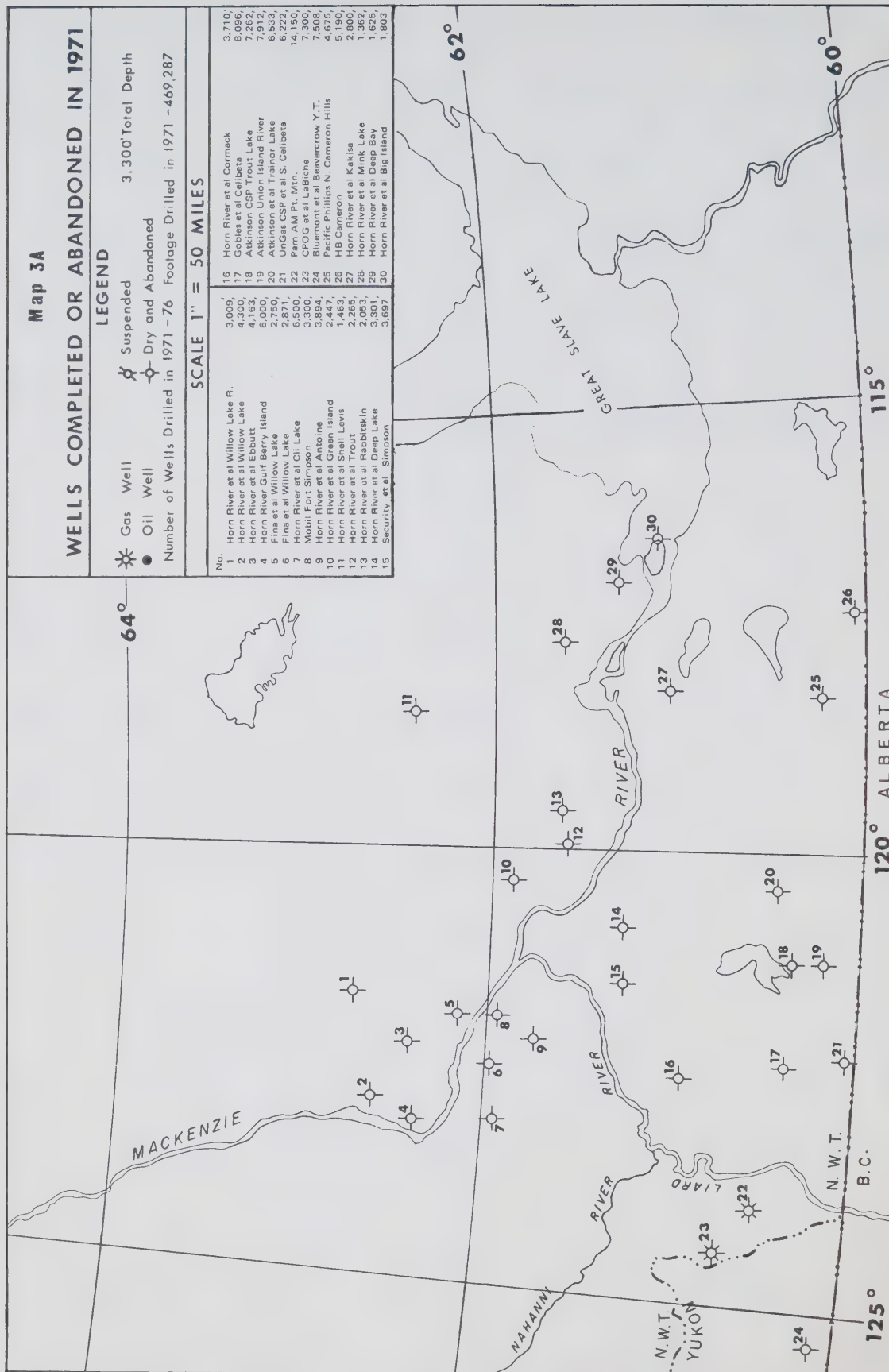
HB Cameron N-24	24-02-71	17-03-71	D & A	5,190
IOE Kanguk I-24	13-02-71	7-03-71	D & A	5,254
IOE Magak A-32	20-12-70	22-01-71	D & A	5,160
IOE Mayogiak J-17	3-04-71	6-08-71	Oil Well	12,093
IOE Taglu G-33	13-04-71	18-08-71	Gas Well	9,823
IOE Tuktu O-19	7-12-70	6-02-71	D & A	7,597
Mobil Fort Simpson M-70	28-01-71	27-02-71	D & A	3,300
Mobil Hume River L-09	16-12-70	9-04-71	D & A	8,550
Mobil et al Iroquois D-40	14-03-71	13-05-71	D & A	8,500
Mobil et al Manuel Lake J-42	13-01-71	6-03-71	D & A	6,710
Pacific Phillips N. Cameron Hills M-05	26-02-71	21-03-71	D & A	4,675
Pan Am Pointed Mountain O-46	29-03-71	2-10-71	Gas Well	14,150
Security GPO&G Simpson O-24A	16-02-71	6-03-71	D & A	3,697
Shell Arctic Red River O-27	26-12-71	23-01-71	D & A	7,067
Shell Arctic Red West G-55	31-03-71	22-05-71	D & A	10,900
Shell Beaver House Creek H-13	23-11-70	27-03-71	D & A	12,295
Shell Tree River East H-57	8-02-71	17-03-71	D & A	6,500
SOBC CS Great Bear River N-30	22-11-71	11-12-71	D & A	2,515
SOBC CS St. Charles Creek H-61	17-12-71	14-01-71	D & A	3,657
UnGas CSP et al S. Celibeta J-13	27-02-71	19-03-71	D & A	6,222

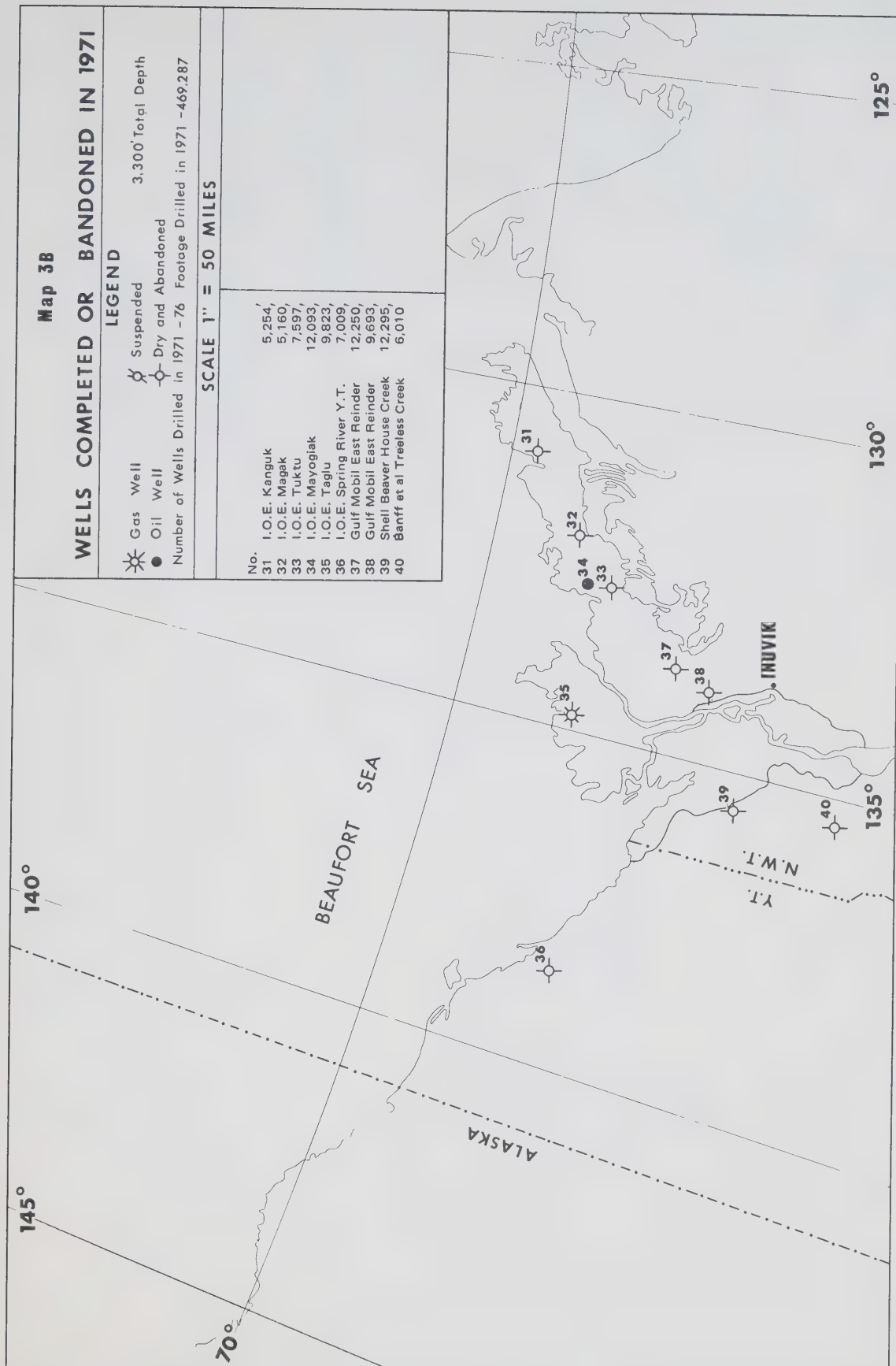
YUKON TERRITORY

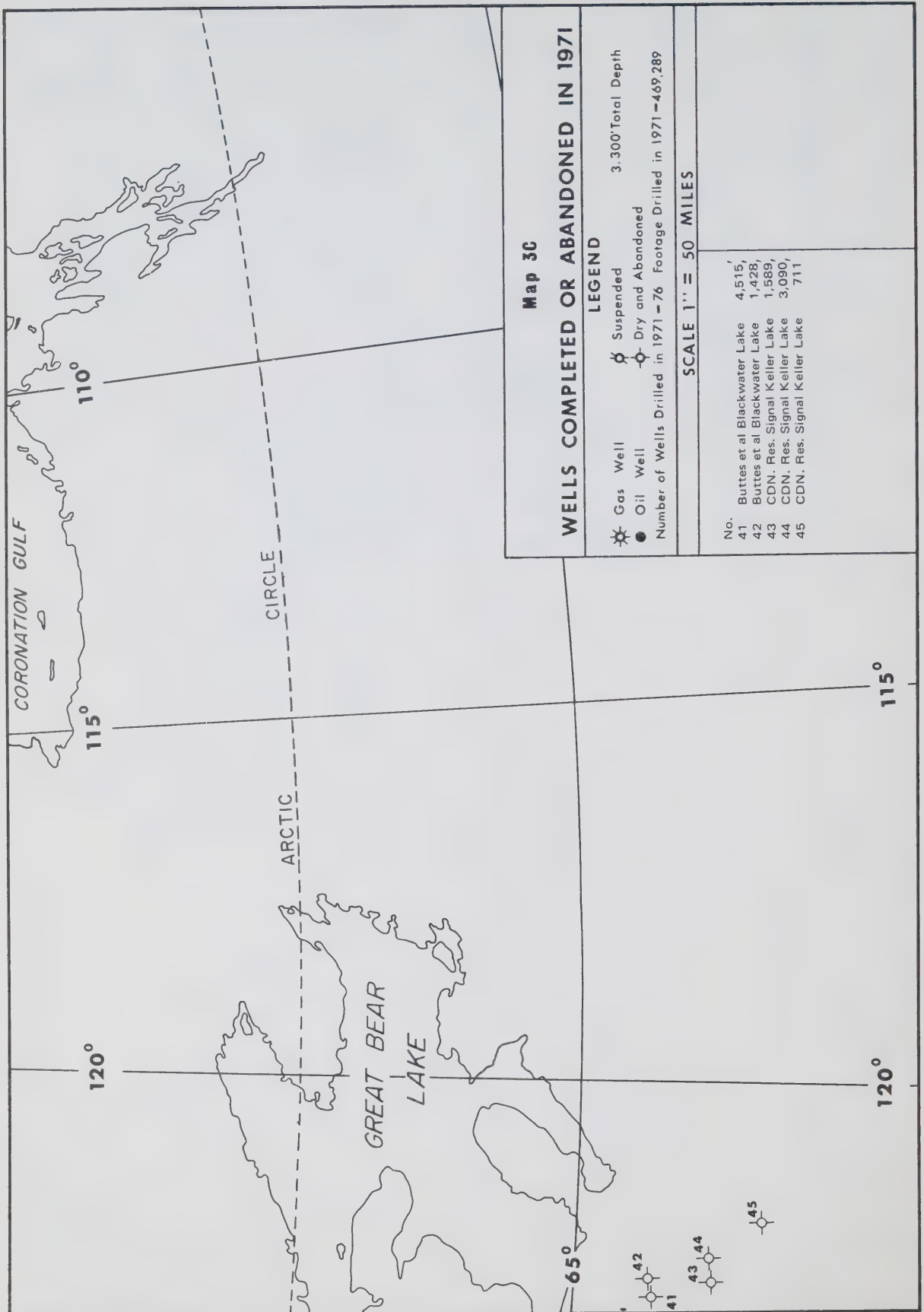
Bluemount et al Beavercrow YT B-16	4-02-71	9-05-71	D & A	7,508
IOE Spring River YT N-58	19-01-71	18-03-71	D & A	7,009
SOBC WM E. Porcupine YT I-13	10-02-71	2-05-71	D & A	8,003
SOBC WM Shaeffer CK YT O-22	12-01-71	9-05-71	D & A	10,373

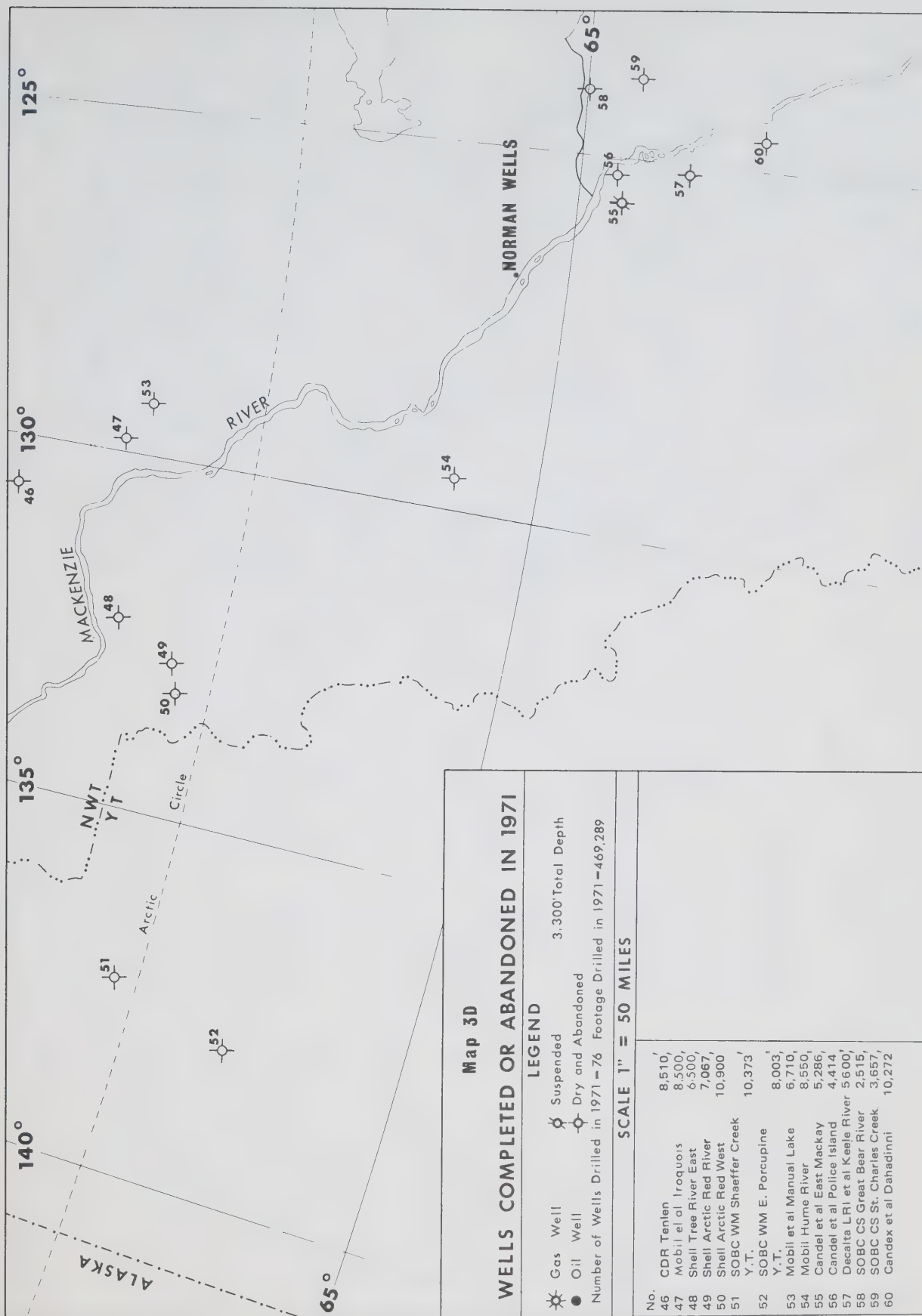
NUMBER OF WELLS DRILLED IN 1971 – 76

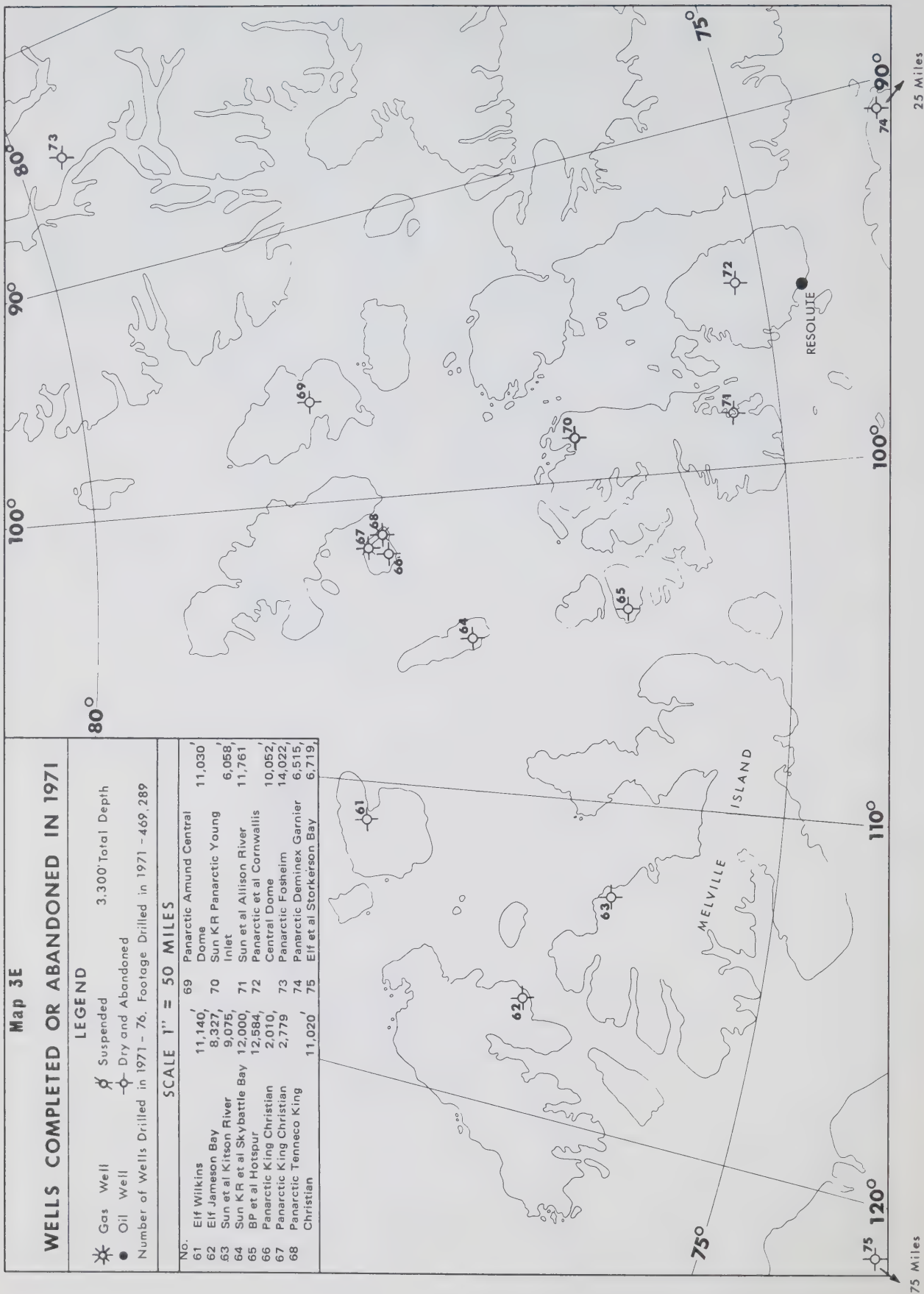
TOTAL FOOTAGE DRILLED 1971 – 469,287

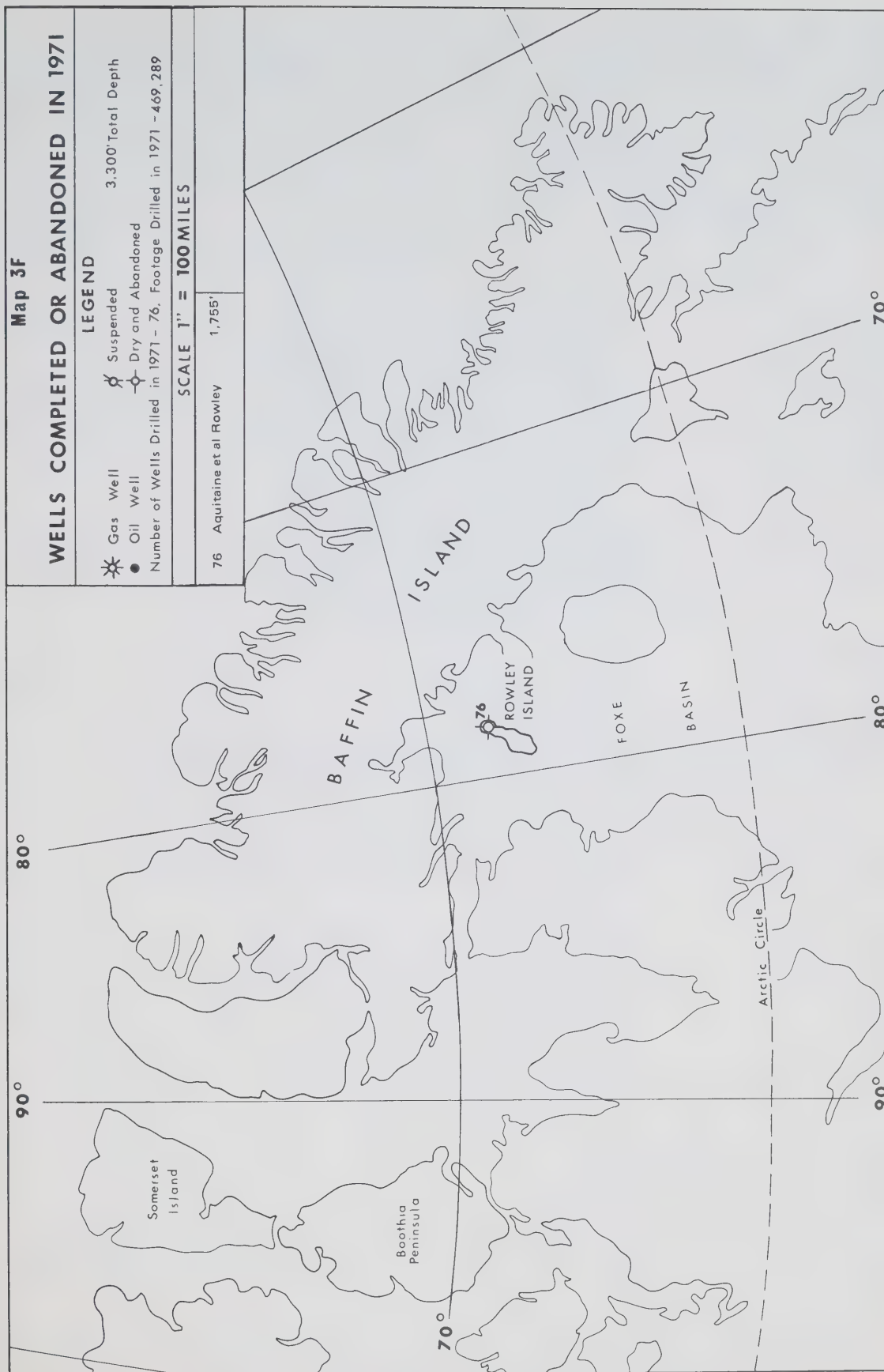












APPENDIX IV

The Oil and Mineral Division is a member of the "Federal-Provincial Committee on Energy Statistics" and the "Mines Ministers Subcommittee on Oil and Gas Statistics" and together with the four western provinces and Statistics Canada has standardized all its oil and gas reporting forms. This standardization has removed duplication between government agencies and more important, industry can now process all oil and gas reporting forms from the western provinces and the Yukon and Northwest Territories on computer machines without change of programs.

FORM NO.	TITLE OF FORM
IAND*52-90-1**	Application for a Drilling Authority
IAND*52-90-2	Well Completion Data
IAND*52-90-3**	Application to Amend a Drilling Authority
IAND*52-90-4**	Application to Change a Well Name
IAND*52-90-5**	Application to Abandon a Well or Suspend Drilling
IAND*52-90-6**	Application to Alter Condition of a Well
IAND*52-90-7	Work-over Report No.
IAND*52-90-8	Application to Commingle Production before Measurement
IAND*52-90-9	Data for Back Pressure Test on Natural Gas Wells — Monograph 7 Method
IAND*52-90-10	Data for Back Pressure Test on Natural Gas Wells Vitter's Method
IAND*52-90-11	M.P.R. — Oil Calculations
IAND*52-90-12	New Oil Well Report
IAND*52-90-13	New Gas Well Report
IAND*52-90-17	New Service Well Report
IAND*52-90-18	Monthly Water Flood Operations Report
IAND*52-90-20	Monthly Water Receipts and Disposal of Fluid Report
IAND*52-90-23	Geologic Surface Survey & Airphoto Analysis — Expenditures
IAND*52-90-24	Land Geophysical Operations — Expenditures
IAND*52-90-25	Marine Geophysical Programs — Expenditures
IAND*52-90-26	Drilling & Structure Test Drilling Expenditures
IAND*52-90-27	Participation Programs — Expenditures
IAND*52-91**	Notice of Commencement of Exploratory Work
IAND*52-92	Application for Authority to Drill Structure Test Hole
IAND*52-93	Report on Abandonment of Structure Test Holes
IAND*52-83	Grouping Notice
IAND*52-103**	Application for Oil and Gas Lease
IAND*52-183	Monthly Accident Summary

*To be completed by Operator.

**To be completed in triplicate; all other forms to be completed in duplicate.

All forms, except IAND 52-83, IAND 52-90-23 to IAND 52-90-27 and 52-103, are submitted to the Oil and Gas Land and Exploration Section, 112 — 11th Ave. S.E., Calgary, Alberta T2G 0X5.

Forms IAND 52-83, 52-90-23 to 52-90-27 and 52-103 are submitted to the Oil and Mineral Division, 400 Laurier Avenue West, Ottawa, Ontario, K1A 0H4.

The following forms have been issued pursuant to the "Canada Oil and Gas Land Regulations" and the "Canada Oil and Gas Drilling and Production Regulations". These forms are to be completed when applicable during the production stage of oil and gas wells, and refinery operations.

FORM NO.	TITLE OF FORM
IAND 52-116-1	Monthly Production Report
IAND 52-116-2	Monthly Disposition and Crown Royalty Statement
IAND 52-116-3	Monthly Gas Gathering Statement
DBS 6511-38*	Monthly Oil Pipeline Gathering Operations Statement
IAND 52-116-5	Monthly Crude Oil and Condensate Purchasers' Statement
IAND 52-116-6	Monthly Gas Plant Statement
DBS 6511-37*	Monthly Natural Gas Distributors Statement
IAND 52-116-8	Monthly Gas Processing Plant Products Statement
IAND 52-116-9	Monthly Liquified Petroleum Gas Purchasers Statement
IAND 52-116-10	Monthly Refinery Operations Report
IAND 52-116-11	Monthly Gas Injection Operations Report
IAND 52-116-12	Statement of Nomination and Estimated Requirement for Crude Oil, Condensate and Pentanes Plus

NOTE: (a) All forms to be completed by the Operator.

- (b) Forms 6511-37 and 6511-38 are completed by the Operator in triplicate. He forwards the first two copies to the Oil and Mineral Division in Ottawa, and the third to the District Oil and Gas Conservation Engineer responsible for the District in which the well is located (see Map 7). The other forms listed above are completed in duplicate. The original is submitted to the Oil and Mineral Division in Ottawa and one copy to the appropriate District Oil and Gas Conservation Engineer.

APPENDIX V

Selected geological references applicable to geological provinces in northern Canada are listed below. References are Geological Survey of Canada publications unless otherwise noted.

NORTHWEST TERRITORIES

- | | |
|--------------|---|
| Memoir 273 | The Lower MacKenzie River Area
G.S. Hume |
| Memoir 322 | Stratigraphy of Middle Devonian and Older Palaeozoic Rocks of the Great Slave Lake Region Northwest Territories.
A.W. Norris |
| Bulletin 95 | Carboniferous and Permian Rocks, Southwestern District of Mackenzie
P. Harker |
| Bulletin 159 | Study of pegmatite bodies and enclosing rocks, Yellowknife-Beaulieu region, District of Mackenzie
R. Kretz |
| Bulletin 163 | A Middle Cambrian Plagiura-Poliella Faunule from Southwest District of Mackenzie
B.S. Norford |
| Bulletin 170 | Middle Triassic (Anisian) ammonoids from northeastern British Columbia and Ellesmere Island
F.H. McLearn |
| Bulletin 185 | Barremian Textulariina, Foraminifera from Lower Cretaceous beds, Mount Goodenough section, Aklavik Range, District of Mackenzie
T.P. Chamney |
| Paper 58-2 | Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains
J.A. Jeletzky |
| Paper 58-11 | Great Slave and Trout River Map Areas
R.J.W. Douglas |
| Paper 59-11 | Horn River Map Area
R.J.W. Douglas, et al |
| Paper 61-1 | Summary Account of Carboniferous and Permian Formations Southwestern District of Mackenzie
P. Harker |

- Paper 61-9 Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell Rivers
J.A. Jeletzky
- Paper 61-13 Camsell Bend and Root River Map Areas
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Oil and Gas Activities 1972

**A Report of Activities in 1972 of the
Oil and Gas Industry in the Yukon
Territory and Northwest Territories**

Compiled by Oil and Gas Land and
Exploration Section
Oil and Mineral Division
Northern Natural Resources and Environment Branch.

(Edition No. 9)

Issued under the authority of
Hon. Jean Chrétien, PC, MP, Minister of
Indian Affairs and Northern Development
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Catalogue No. R71-6/1972
IAND Publication No. QS-1510-000-EE-A1

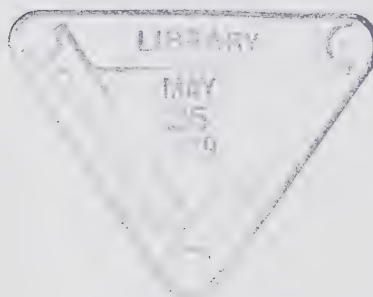


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Introduction

All aspects of oil and gas operations in the Yukon and Northwest Territories are administered by the Department of Indian Affairs and Northern Development, specifically by the Oil and Mineral Division. It is the intent of the Department to provide a regulatory climate that will best encourage and provide for the orderly exploration and exploitation of oil and gas, thereby achieving benefits of a local nature to the specific areas involved and to the people of Canada in general through the attendant revenues accruing to the Crown.

The Minister and officers of the Department of Indian Affairs and Northern Development as of March 1, 1973, who are responsible for administering oil and gas resources in the Northwest Territories and Yukon Territory, and northern offshore areas, are:

Minister — The Hon. Jean Chrétien, P.C., M.P.
Deputy Minister — H.B. Robinson
Assistant Deputy Minister (Northern Development) — A.D. Hunt
Director Northern Economic Development Branch — F.J. Joyce
Chief, Oil and Mineral Division — Dr. H.W. Woodward

Oil and Gas Land and Exploration Section

Administrator, Oil and Gas — R.R. McLeod
Supervisor, Geological Operations Unit — S.A. Kanik
Supervisor, Geological Evaluation Unit —
Supervisor, Land Unit — P. Sullivan

Oil and Gas Drilling and Conservation Section

Chief Petroleum Engineer — Dr. H.J. Berry
Assistant Chief Petroleum Engineer, Drilling & Conservation
— M.K. El-Defrawy
Assistant Chief Petroleum Engineer, Offshore — S.V.
Benediktson
Assistant Chief Petroleum Engineer, Reservoir
Assistant Chief Petroleum Engineer, Production Systems
— R.L. Price
Regional Oil & Gas Conservation Engineer — M.D. Thomas in
Yellowknife
District Oil and Gas Conservation Engineers —
— A.J. McCaskill for Arctic Island in Calgary, District 1
— A.F. Halcrow for N.E. & N.W. Sectors in Inuvik,
District 2 & 3
— G.E. Blue for S.W. Sector in Yellowknife, District 4
for S.E. Sector in Yellowknife, District 5

Potential of the Geologic Basins

Geological Summaries

In Canada, north of latitude 60°, the land area not covered by sea and outside the provinces covers 1,458,784 square miles. Of this area a total of 465,000 square miles are underlain by sedimentary rocks (Map No. 1). The vast sedimentary region, including the area covered by seas, is divided for convenience into geographical provinces. A summary of some of the geographical provinces is given and a selected list of relevant geological references included.

Geographical Provinces

Arctic Islands

1. Arctic Lowlands
2. Franklinian Geosyncline
3. Sverdrup Basin
4. Arctic Coastal Plain
5. Baffin Bay-Davis Strait

Mainland

6. Eagle Plain
7. Interior Plains (Part of the Western Canada Sedimentary Basin)
 - Anderson Plain
 - Great Bear Plain
 - Great Slave Plain
 - Peel Plain
 - Mackenzie Plain
8. Liard Plateau
9. Mackenzie Delta

The portion of Canada north of the mainland, and north and west of the Canadian Shield is divided into four major geographical provinces; (1) Arctic Lowlands (2) Franklinian Geosyncline (3) Sverdrup Basin (4) Arctic Coastal Plain and Banks Basin.

1. Arctic Lowlands

The Arctic Lowlands are intermediate in position between the Canadian Shield to the south and the Franklinian geosyncline to the north and west. The area is underlain by thin, gently dipping, relatively undisturbed, Lower Paleozoic carbonates which overlie the craton and thicken northward towards the geosyncline. Three cratonic arches extend northward from the Shield and divide the Lowlands into several individual basins, the Foxe Basin being the one farthest to the east. To date three unsuccessful tests have been drilled within the Arctic Lowlands.

2. Franklinian Geosyncline (Arctic Fold Belt)

The limits of Paleozoic deformation define the division between the Franklinian geosyncline and the Arctic Lowlands to the south and east. The geosyncline was the site of

continuous sedimentation from Cambrian to Upper Devonian time. Two depositional belts are recognized; a miogeosynclinal belt extending from Banks Island to northern Greenland, and a eugeosynclinal belt exposed only on Axel Heiberg and Ellesmere Island. Thick carbonates and clastics constitute potential reservoirs. Strata were folded in the Ellesmerian orogeny of Late Devonian or Early Carboniferous time; these folded strata constitute the basement underlying the Sverdrup basin. No commercial production has been discovered to date.

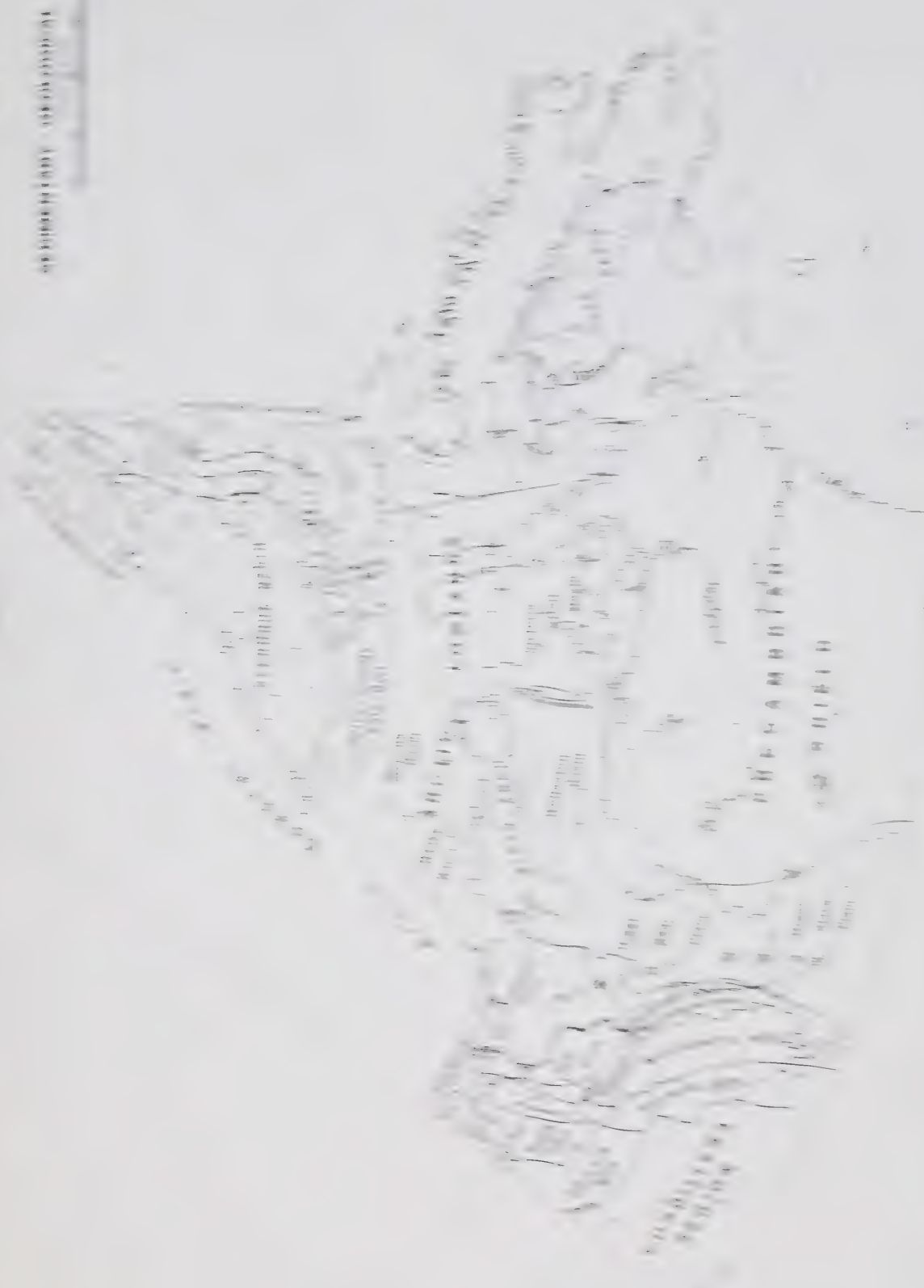
3. Sverdrup Basin

A major angular unconformity marks the base of the Sverdrup basin stratigraphic succession; Lower Pennsylvanian to Tertiary strata overlie folded Paleozoic strata of the Franklinian geosyncline. The structural and stratigraphic axis of the Sverdrup Basin strikes north east from Banks Island to northern Ellesmere Island; the greatest accumulation of sediment, in excess of 25,000 feet, is found along this axis. The succession thins and contains a number of unconformities in all directions away from this axis. In three dimensions, this sedimentary accumulation thus has the shape, in both a structural and stratigraphic sense, of an elongate basin to which the name Sverdrup Basin has been applied. Thickness and facies indicate that the present south and east limits of the basin are close to the original depositional limits; Tertiary strata of the Arctic Coastal Plain mask the northern and western margins. Evaporites of late Paleozoic age form piercement structures in the axial area of the basin. The lower part of the Upper Cretaceous series and older sediments are intruded by igneous sills and dikes of varying thickness, the igneous activity was concentrated in the eastern half of the basin. The Eurekan Orogeny in latest Cretaceous and early Tertiary time produced folding and faulting throughout the basin; deformation was accompanied by emplacement or reactivation of the piercement bodies. Thick arenaceous sequences, particularly in the Triassic and Jurassic, are potential hydrocarbon reservoirs. Five gas fields have been discovered in the Sverdrup Basin. In chronological order of discovery they are; Drake Point, King Christian, Kristoffer Bay, Hecla and Wallis. Potential oil producing areas have been indicated at Thor Island and Fosheim Peninsula on Ellesmere Island.

4. Arctic Coastal Plain and Banks Basin

The north and west margins of the Sverdrup Basin are covered by thick, relatively undisturbed, Tertiary and Pleistocene clastics that outcrop along the coast of the Arctic Ocean. Beds dip gently and thicken towards the

THE HISTORY OF THE
CITY OF NEW YORK
FROM 1624 TO 1800



continental shelf. The Banks Basin is situated on Western Banks Island and in the adjacent continental shelf and slope areas. The extensive cover of Mesozoic to recent clastics thicken in the offshore area. Three unsuccessful tests have been drilled to date on Banks Island.

5. *Baffin Bay-Davis Strait Basin*

The Baffin Bay-Davis Strait basinal area is entirely in the offshore and has been explored to date only by regional geophysical surveys. Several theories to explain the origin of the basin have been advanced; a widely accepted one involves continental drift, Greenland and the Baffin land mass rotated apart from a pivotal point to the north west. Geophysical surveys have demonstrated that the basin is underlain by oceanic crust, that no mid basin ridge has been found, and as much as 25,000 feet of semi-consolidated clastics are present. Sediments thin to zero in near shore areas and on the Davis Strait Sill. Rocks outcropping around the basin margins are predominantly Precambrian. Major centers of deposition are the Thule Basin, Lancaster Delta and Cumberland Delta; the central portion of the basin is underlain by up to 20,000 feet of flat lying, relatively undisturbed sediments. Lancaster Sound and Jones Sound are structural controlled grabens in which thick deltaic clastics accumulated. Sediment source area was to the west; a major Tertiary drainage system transported sediment to the Baffin basin. The large volume of geologically young sediments and the presence of favourable trapping conditions for hydrocarbons make the Baffin Basin-Davis Strait area a favourable one for future hydrocarbon production.

The geographical provinces of the Mainland consist of two major districts, the Interior Plains and the Mackenzie Delta. The Interior Plains district is subdivided into five geographical areas for convenience. The Eagle Plain and Liard Plateau provinces are included because they have economic potential.

Eagle Plain

The Eagle Plain basin is tectonically altered. The basin is contained between the Ogilvie and Richardson Mountains, with sediments approaching 20,000 feet in thickness of which about 10,000 feet are late Paleozoic to Mesozoic in age.

Gas and oil have been found in Pennsylvanian sand at the Chance Pool, and gas in Cretaceous sands at the Chance, Birch and Blackie pools.

Interior Plains

Anderson Plain

The Anderson Plain lies east of the Mackenzie Delta. Cretaceous beds cover much of the plain area and lie unconformably on lower and Middle Paleozoic beds. Sediments over 8,000 feet in thickness occur in a SW-NE trend through the wells C.P.O.G. Kugaluk N-02 and Elf Horton River G-02.

Great Bear Plain

The Great Bear Plain consists of Lower and Upper Cretaceous sediments partially covering a bedrock of Ordovician to Devonian age. The total sediments wedge from 0 feet in thickness to the east to over 6,000 feet in the west along the eastern edge of the Franklin Mountains.

Great Slave Plain

The Great Slave Plain encompasses an area extending westward from the Great Slave Lake to the Liard Plateau and the Mackenzie Mountains. Gas pools are found at Bovie Lake, Cameron Hills, Celibeta, Netla, Rabbit Lake, South Island River and at Trainor Lake. The gas occurs in the porous dolomites and limestones of Middle Devonian age.

Peel Plain

The Peel Plain lies to the NE of the Peel Plateau and NW of the Mackenzie Plain. The Plain is covered by Cretaceous and Jurassic sediments which overlie Paleozoic carbonates and shales. The sediments are similar to those of the Mackenzie Plain and range in thickness from over 14,000 feet in the south west to 8,000 feet in the north east.

Mackenzie Plain

Oil is produced in the Mackenzie Plain at Norman Wells. The producing horizon is the Devonian Kee Scarp.

Liard Plateau

The Beaver River and Pointed Mountain fields produce gas from dolomites of the Nahanni Formation of Middle Devonian age. Production comes from large faulted anticlines near the western edge of the Great Slave Plain.

Mackenzie Delta

The Mackenzie Delta is made up of thick deposits of potentially productive Cretaceous and Tertiary sands. The prograding Tertiary deltaic deposits appear to be related to a tensionally unstable area of the coastal margin where normal faulting occurs. The delta is sometimes referred to as part of the Mackenzie Basin. The Mackenzie Basin occurs at the south end of the Beaufort sea, bounded by the Romanzof uplift to the south west and the Aklavik arch complex to the south east.

Oil is found in Paleozoic carbonates, Lower Cretaceous sands and Tertiary sands in the Mayogiak, Atkinson and Ivik pools.

Gas is found in Cretaceous and Tertiary sands at the Mallik, Niglintgak, Parsons, Taglu and Ya Ya pools.

The Beaufort Sea

The Beaufort Sea covers a large area north of the mouth of the Mackenzie River. The area includes the Arctic Coastal Plain, part of the Banks Basin, part of the Mackenzie Delta, the Yukon Coastal Plain and extends westward north of Alaska. The coastal plains of the Beaufort Sea have excellent structures suitable for trapping hydrocarbons.

Area and Volume of Sediments

In sedimentary areas, which are relatively unexplored by drilling, there are various ways in which an estimate of the possible oil and gas potential may be made. One of the more commonly used methods is that of estimating the volume of sediments within the basins and comparing these with other sedimentary basins of the world in more advanced stages of development.

The area of the islands underlain by sedimentary rocks is about 350,000 square miles. Since measured and estimated

stratigraphic sections are widely dispersed, an approximation for the average thickness was taken to be 10,000 feet. For purposes of computing the volume of sediments, only the areas between the 1,000 feet isopachous lines were used, and the thickest sedimentary sections were used. The thickest sedimentary sections were taken to be 16,000 feet. Below 16,000 feet, very few wells are productive from the older sediments, although younger sediments at this depth may provide excellent reservoirs. On this basis the volume of sediments in the Northwest Territories and Yukon is approximately 332,000 cubic miles.

A comparison of the sedimentary areas and volumes in the Western Provinces and in the Yukon, Northwest Territories and Arctic Islands is given in Table No. 1.

Table No. 1 — Volume of Sediments

Area	Area (Sq. Miles)	Volume of Sediments (Cu. Miles)
Manitoba and Saskatchewan	176,623	168,072
Alberta	236,893	341,715
British Columbia	50,688	115,318
Yukon	43,000	64,500
Northwest Territories	204,794	267,133
Arctic Islands	350,000	663,500
	1,061,998	1,620,238

Oil and Gas Discoveries

Norman Wells is the only producing oil field North of the 60th parallel. The field was discovered in 1920, but intensive commercial development did not take place until World War II. During 1972 oil was produced at an average rate of 2,620 barrels daily and refined locally.

Imperial Oil announced additional gas discoveries in the Delta area in 1972. IOE Taglu West P-03 and Taglu C-42 were completed in the Taglu gas field, and Mallik A-06 discovered significant amounts of gas. In the same area Gulf Oil made a significant gas discovery in their Parsons F-09 well.

Panarctic Oils Ltd. in 1972 drilled four successful gas wells on Sabine Peninsula. This brings to ten the number of gas discoveries on the Arctic Islands by Panarctic Oils to the end of 1972. It follows up the 1969 Panarctic gas discovery on Drake Point, Melville Island; in 1970, Panarctic discovered gas on King Christian Island, and in 1972 at Kristoffer Bay B-06. These discoveries will be evaluated in the near future, to determine the areal extent of reservoirs. (See Appendix II for a complete list of oil and gas discoveries and Map No. 4 showing the location of all the oil and gas fields and discoveries.)

Reserves

A. Crude Oil Reserves

The geological basins comprising the Territories and Arctic Islands are only in the initial stages of exploration, so definitive crude oil reserves have little meaning at this time. However, the "Potential Reserves of Crude Oil Recoverable by Conventional Methods", compiled by the Canadian Petroleum Association, and released in April, 1969, are considered authoritative. The Canadian Petroleum Association report states that the potential crude oil reserves for "all of Canada

recoverable by conventional means is 120.8 billion barrels". Of this total, 43.45 billion barrels is assigned to the Arctic Islands and Coastal Plain area and (by interpolation) approximately 15 billion are calculated for the rest of the Northwest Territories and the Yukon Territory. Thus, about 60 billion barrels of oil, or 50% was computed to be located North of 60.

The Association, in an annual report outlining the reserves for Canada, states that at December 1, 1970, proved reserves assigned to the Northwest Territories (Norman Wells field) were 45.21 million barrels.

B. Natural Gas Reserves

In the April 1969 report, the "Potential Raw Gas Reserves" for Canada are given as 724.8 trillion cubic feet. The potential reserves computed for the Arctic Islands are 260.7 trillion cubic feet; those for the rest of the Northwest Territories and the Yukon Territory (by interpolation) are calculated at approximately 90 trillion cubic feet.

Recent reports of reserves are given by the Canadian Petroleum Association as 1.006 tcf Proved and 1.403 tcf Proved and Probable for the Pointed Mountain gas field. The report did not assign any gas reserves to the Yukon portion of the Beaver River gas field, to 12 individual gas well discoveries in the Yukon and Northwest Territories or to the ten gas discoveries in the Arctic Islands.

Refining Operation

Refining Capacity

As noted in a previous section the only operating refinery located North of 60 is at Norman Wells and is operated by Imperial Oil Ltd. This refinery has a calendar day capacity of 1,500 barrels and a stream day capacity of 1,600 barrels. An extensive modernization program was commenced in 1969 and completed in 1971 to improve facilities such as barrel-filling, wharf-loading and the water-purifier plant.

Activities - 1972 — Land

Land activities, as may be seen in the Land Map (Map No. 1) and in Table No. 2, was characterized by a high degree of stability in total permit and lease holdings.

With the review of the Regulations currently under way, no permits were granted after March 21, 1972. However, applications for permits have been received for some 41,000,000 acres in the Wollaston and Victoria Straits Basins, and offshore of the Western Arctic Islands and Baffin Bay. The negotiations between the Federal Government and the Maritime Provinces respecting the administration of East Coast offshore lands has delayed the issuance of leases. Some 470 lease applications from the Norman Wells area to King Christian Island in the high Arctic covering 2,700,000 acres have been received.

Table No. 2 — Number of Permits and Leases, and Relevant Acreage — December 31 1972

Area	No. of Permits	Acreage
N.W.T. Mainland	1,976	89,384,248
Yukon Mainland	551	22,975,845
Arctic Islands	5,412	268,313,405
Arctic Coast Marine	1,331	64,397,346
	9,270	445,070,844

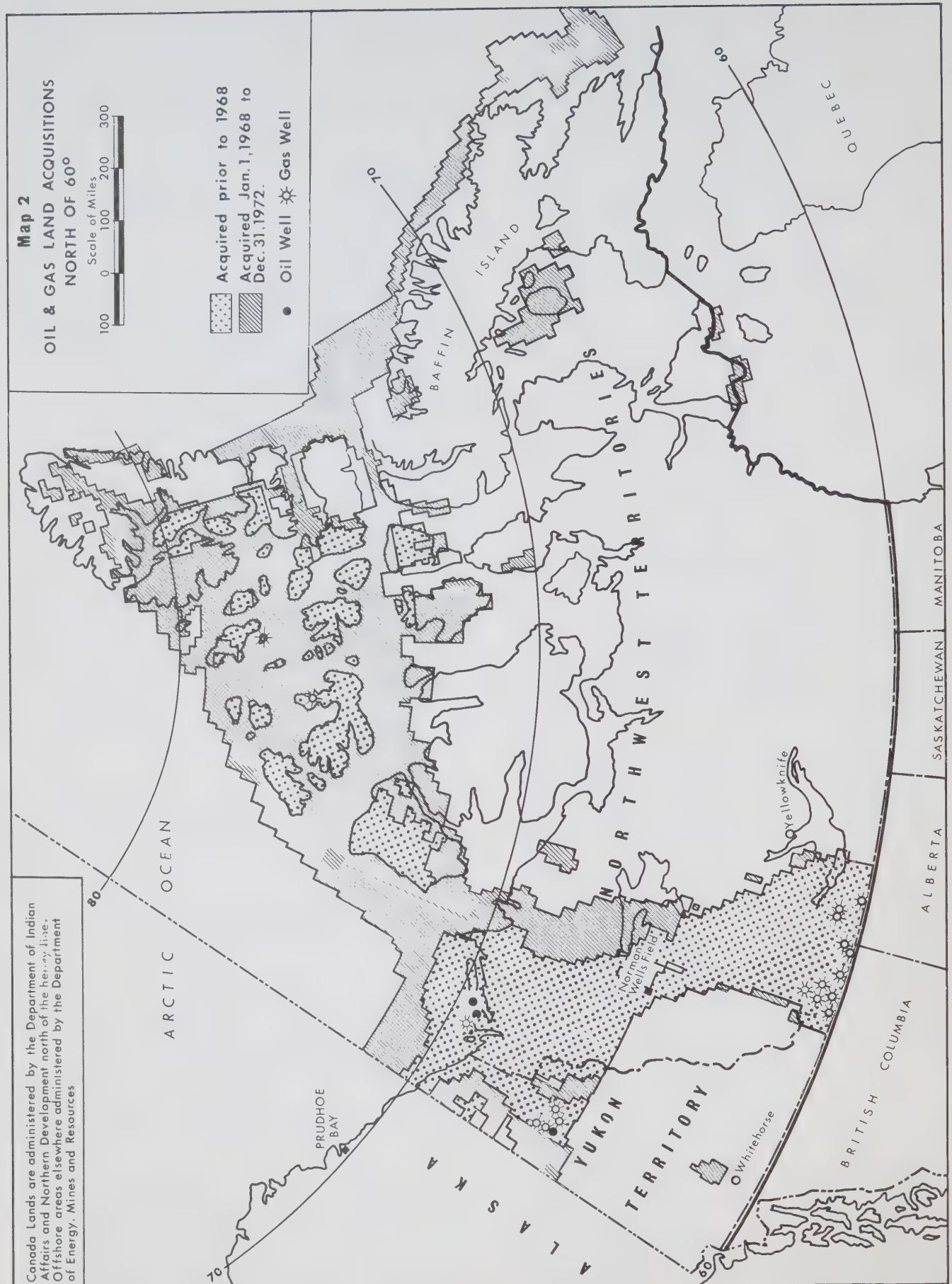


Fig. 1
ACREAGE HELD UNDER OIL & GAS PERMIT
 YUKON TERRITORY AND NORTHWEST TERRITORIES

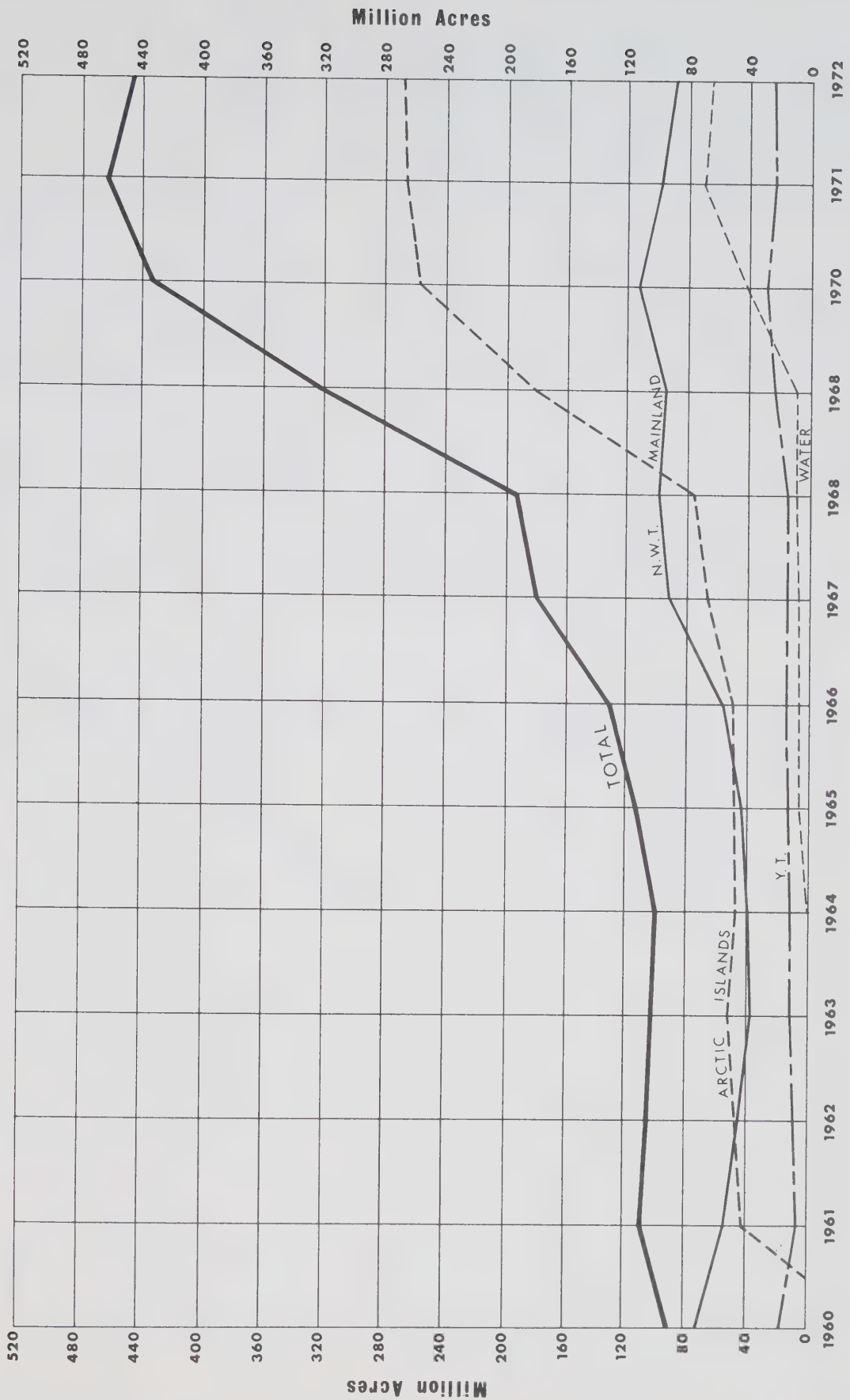
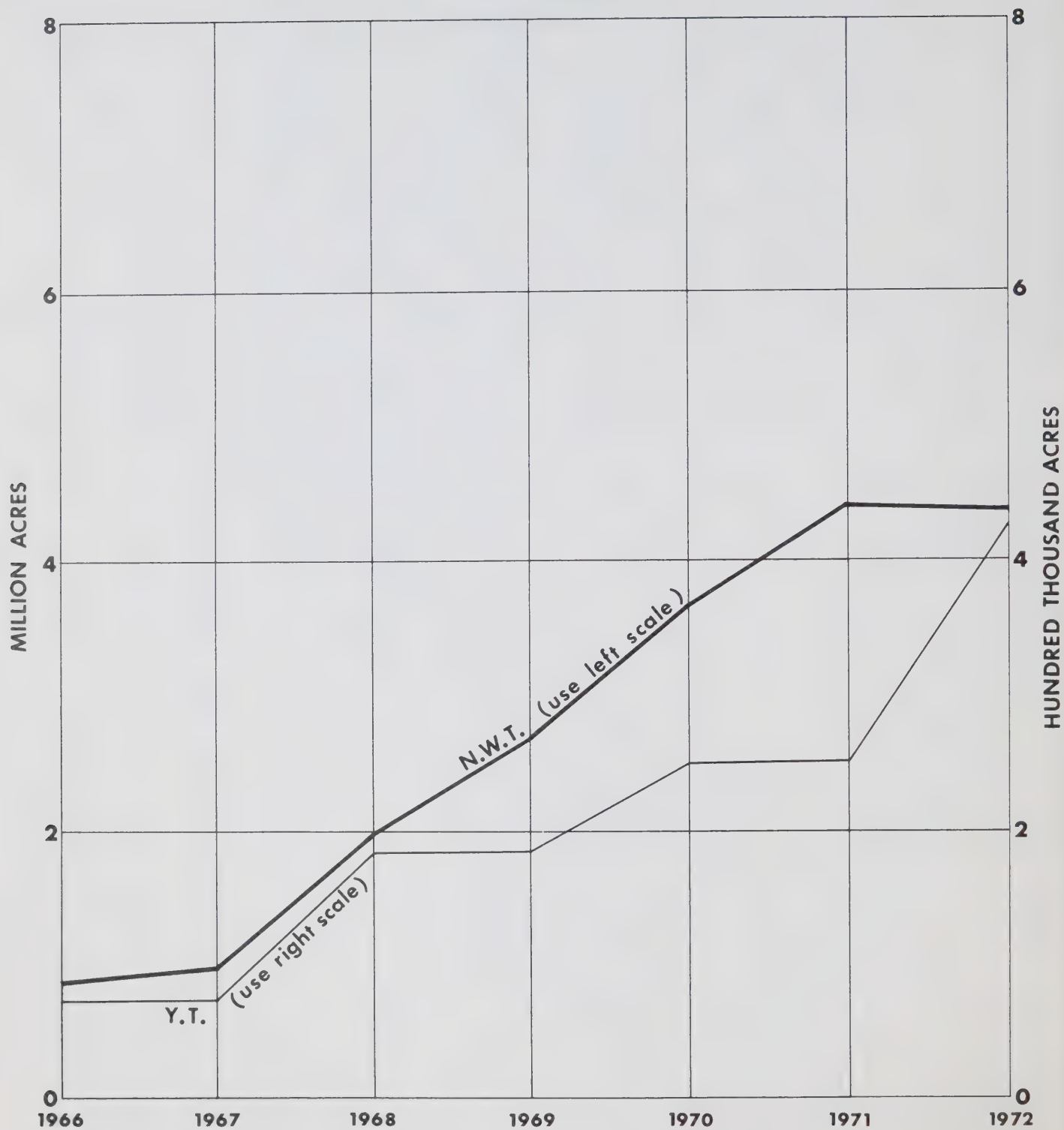


Fig. 2
YUKON TERRITORY - NORTHWEST TERRITORIES
ACREAGE UNDER LEASE
BY YEAR



Area	No. of Leases	Acreage
N.W.T. Mainland	754	4,466,085
Yukon Mainland	93	427,854
Arctic Islands	Nil	Nil
Arctic Coast Marine	Nil	Nil
	847	4,893,939
Total Permits and Leases	449,964,783	acres

The minor decreases in holdings (4% overall) was principally due to the lack of success in the Frontier areas South of 70° and the growing maturity of the permits in the Yukon and southern Northwest Territories. More than 4 million acres were surrendered in the Foxe Basin and 1.3 million acres were released in the Old Crow area of the Northern Yukon. All permits issued in the high Arctic in 1968 reached the end of their second period in 1972. The rather high degree of optimism in industry is shown in the fact that the majority of those permits have been maintained in good standing to the end of their initial term. Some 80 million acres of permits issued in 1969 will require further deposits during 1973. The permits in 1969 were largely issued in the more remote and difficult areas of the high Arctic and the 1973 permit terminations should be somewhat more than those in 1972.

No public offerings of Oil and Gas Rights were made in 1972. The last invitation to tender on Crown Reserve Lands was made in January, 1969.

Oil and Gas Land Regulations

The Permit terms under the *Canada Oil and Gas Land Regulations* are summarized in Figures 3 and 4. Figure 3 shows the term in years, including six annual renewals beyond the initial term and the total per acre minimum work requirements to be met during the maximum permit life. The minimum deposit and work requirements for each period of the permit life is illustrated in Figure 4.

Land Order 1-1961 was revoked in May of 1970. However, the additional royalty terms under that Order for each area are shown in Figure 5. Some 93 leases granted under the Order were in good standing as of December 31, 1972.

Figure 6 describes the flow of Canada Oil and Gas Lands under the Regulations through the various disposal methods.

Only one change to the Regulations was made in 1972. Section 55 was amended to provide that private corporations that are owned by Canadian individuals and corporations could qualify to hold leases. This section previously restricted lease ownership to private corporations held by Canadian individuals.

Exploration

Figures 7, 8, 9 and 10 graphically depict exploration activities North of 60 in 1972. Expenditures on oil and gas exploration in the Northwest Territories and Yukon Territory exceeded \$238 million in 1972, an increase of \$58 million over the previous year. Exploratory and development drilling increased nearly 60% up to \$126 million dollars, while total geological and geophysical expenditures increased 10% to over \$100 million. Expenditures for exploration drilling and seismic

exploration exceeded similar work in every province, and the combined Atlantic and Pacific offshore areas.

Figure No. 7 indicates that expenditures increased by 35% in 1971 and by 32% in 1972. Indications in early 1973 are that these expenditures will again increase in 1973, and best estimates are that they may approximate \$250 million. By 1975, expenditures related to oil and gas activities should reach \$300 million per year. With the advent of development drilling in the Delta and possible construction of the Mackenzie Valley Gas Pipeline, expenditures in the late 70's may exceed \$1 billion a year.

Seismic crew months, depicted in Figure 8, is an excellent barometer of the magnitude of the drilling activity for the next two years. In 1972, oil companies conducted 240 crew months of seismic work in land and marine areas, increasing the level of work from the previous year by about 10%. This would indicate a moderate increase in drilling activities in 1973.

Figure 9 and 10 illustrate the number of wells drilled and the amount of footage drilled during the past ten years. Note that footage increased by five times the 1968 total. This is also reflected in the expenditure increase for drilling in that there has been a 16 fold increase in drilling expenditures during the same interval. The large increase in drilling expenditures is attributed to the high cost of drilling wells on the Arctic Islands and Mackenzie Delta, in that about one-half of the wells were drilled in the frontier areas.

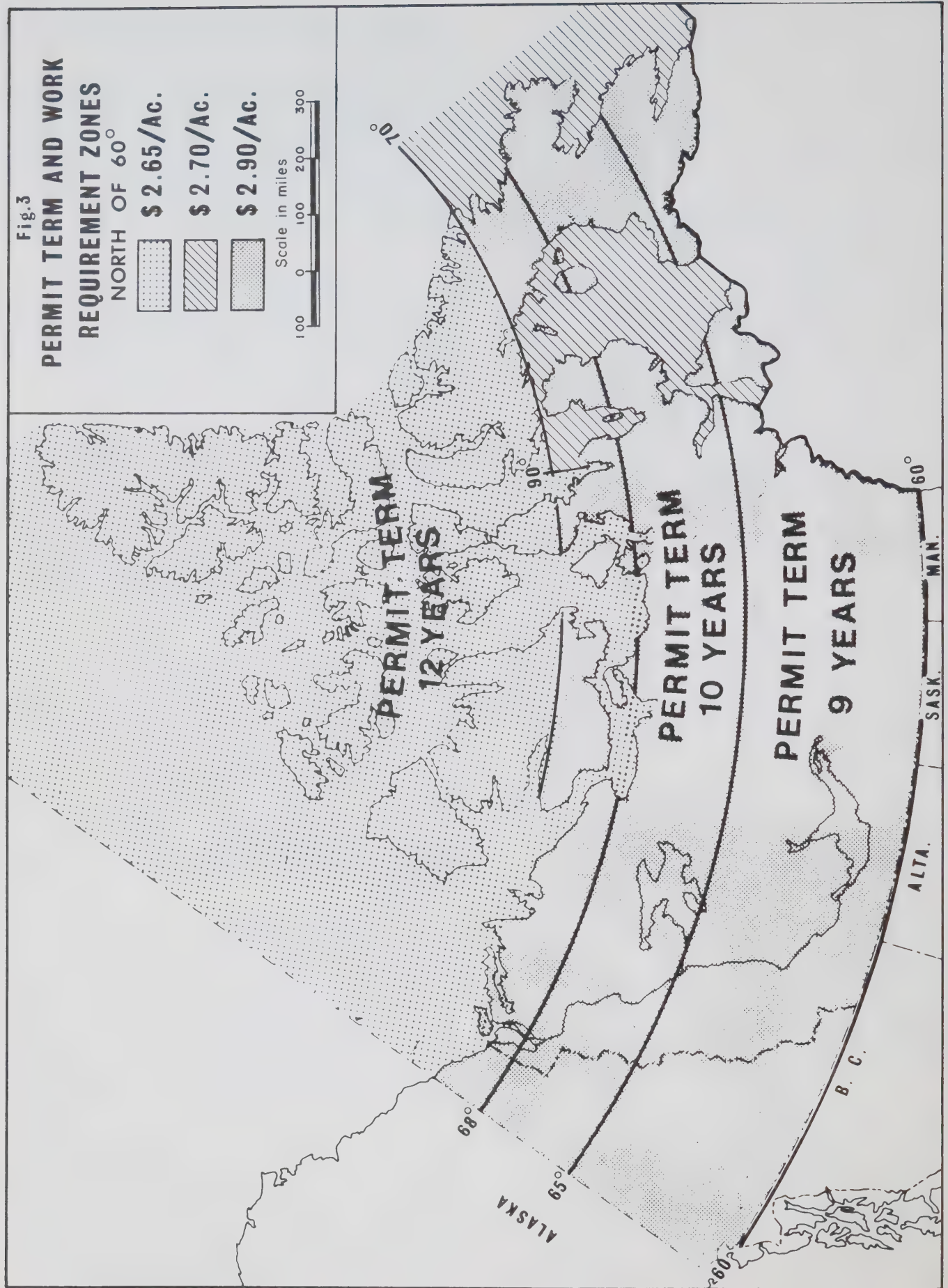
Operations

Significant applications for permits have been received for some 41 million acres in the Wollaston and Victoria Straits Basins and off-shore on the Western Arctic Islands and Baffin Bay. On the Mainland, applications were received for the area north of Great Bear Lake. Scattered acreage in small lots were filed on by several companies and individuals.

Permits were surrendered or cancelled along the periphery of many basins on the Mainland and Arctic Islands. Several million acres of permits were also surrendered in the Peel Plateau area. Leases were surrendered in the southern Northwest Territories.

Surface geological and photogeological surveys totalling 140 geological crew months, were carried out on Canada Lands North of 60. Participation surveys by V. Zay Smith and Associates, Kenquest Explorations Limited and J.C. Sproule and Associates contributed significantly to the total surface exploration program. Imperial Oil Ltd. and Chevron Standard continued surface exploration in the northern Yukon Territory and Northwest Territories, while Panarctic Oils Ltd., ARCO, and Canada Cities Service continued major mapping programs on the Arctic Islands.

Seismic activity was general over many of the geological basins in the north. Detailed seismic work was carried out by many companies in the southern part of the Northwest Territories and in the Eagle Plain area. Imperial Oil Enterprises, Gulf Oil Canada Ltd., Shell Oil Canada and Bow Valley continued to carry out large reflection programs along the Arctic Coastal Plain and in the Mackenzie Delta-Tuk areas. Five reflection





Photograph No. 1 Drilling Operations in the Mackenzie Delta (*Courtesy — Imperial Oil Ltd.*)



Photograph No. 2 Seismic Operations on Richards Island in the Delta (Courtesy — Imperial Oil Ltd.)

Fig. 4

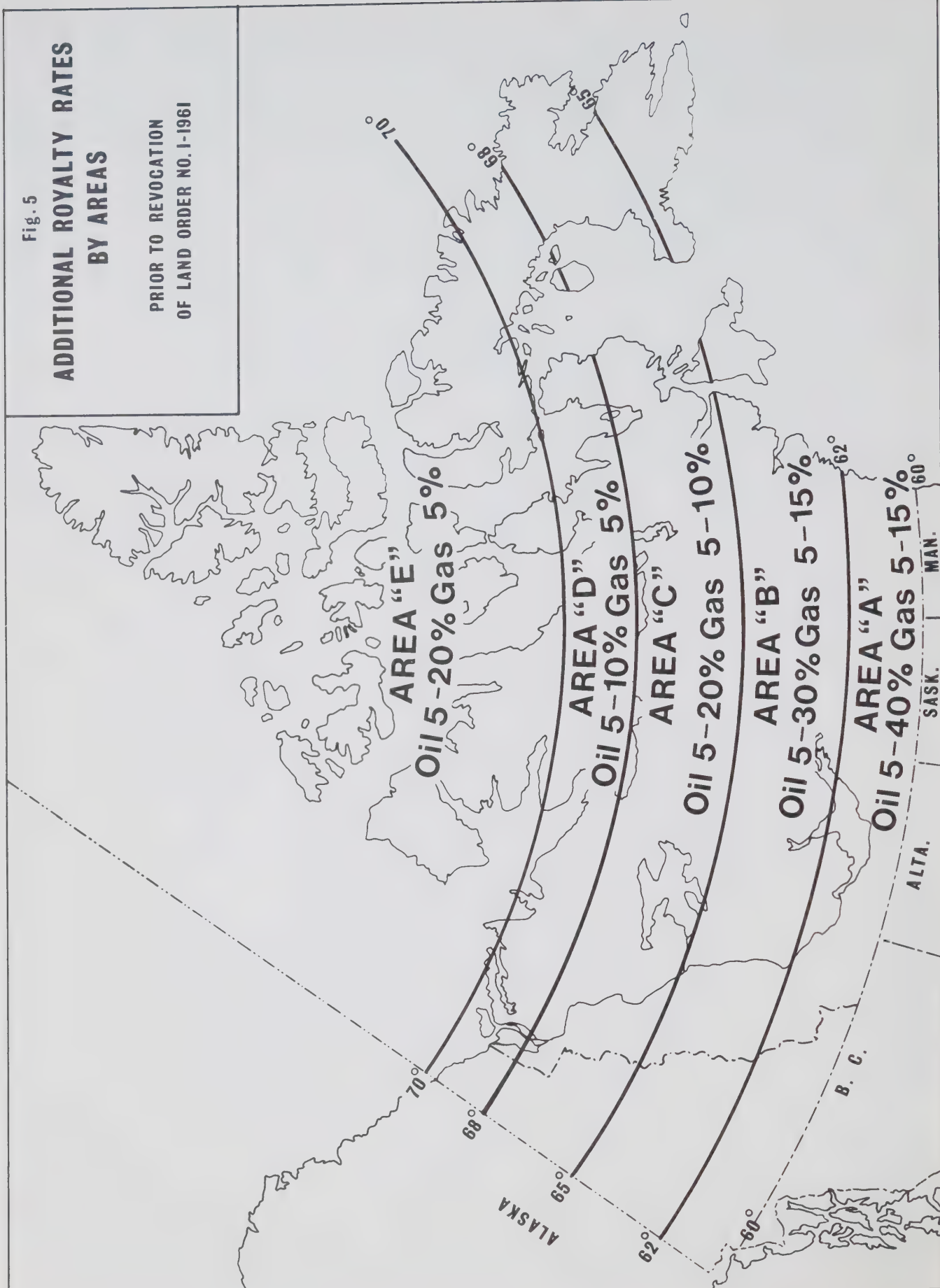
YUKON TERRITORY - NORTHWEST TERRITORIES PERMIT TERMS AND DEPOSIT REQUIREMENTS — PER ACRE

PERMITS LOCATED BETWEEN LATITUDES	RENEWAL TERMS														TOTAL WORK REQUIREMENTS
	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs	
60° - 65°	3 YEARS														\$ 2.90
	5 ¢	15 ¢			30 ¢	40 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	
	4 YEARS														
65° - 68°	5 ¢	15 ¢			30 ¢	40 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	\$ 2.90
	6 YEARS														
	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	
68° - 70°	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	\$ 2.90
	6 YEARS														
	5 ¢	15 ¢			20 ¢	40 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	
NORTH OF 70°	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	\$ 2.65
	6 YEARS														
	5 ¢	15 ¢			20 ¢	40 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	
MARINE PERMITS LOCATED SOUTH OF 70° N WEST OF 90° W	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	\$ 2.65
	6 YEARS														
	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	
SOUTH OF 70° N EAST OF 90° W	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	\$ 2.70
	6 YEARS														
	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	
PERMITS LOCATED NORTH OF 70° ISSUED PRIOR TO 1968	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	\$ 2.65
	8 YEARS														
	5 ¢	15 ¢			20 ¢	30 ¢	40 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	
MARINE PERMITS SOUTH OF 70° ISSUED PRIOR TO 1969	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	\$ 2.70
	6 YEARS														
	5 ¢	15 ¢			20 ¢	30 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	50 ¢	

Fig. 5

ADDITIONAL ROYALTY RATES BY AREAS

PRIOR TO REVOCATION
OF LAND ORDER NO. 1-1961



FLOW DIAGRAM OF DISPOSAL OF OIL AND GAS RIGHTS

Fig. 6

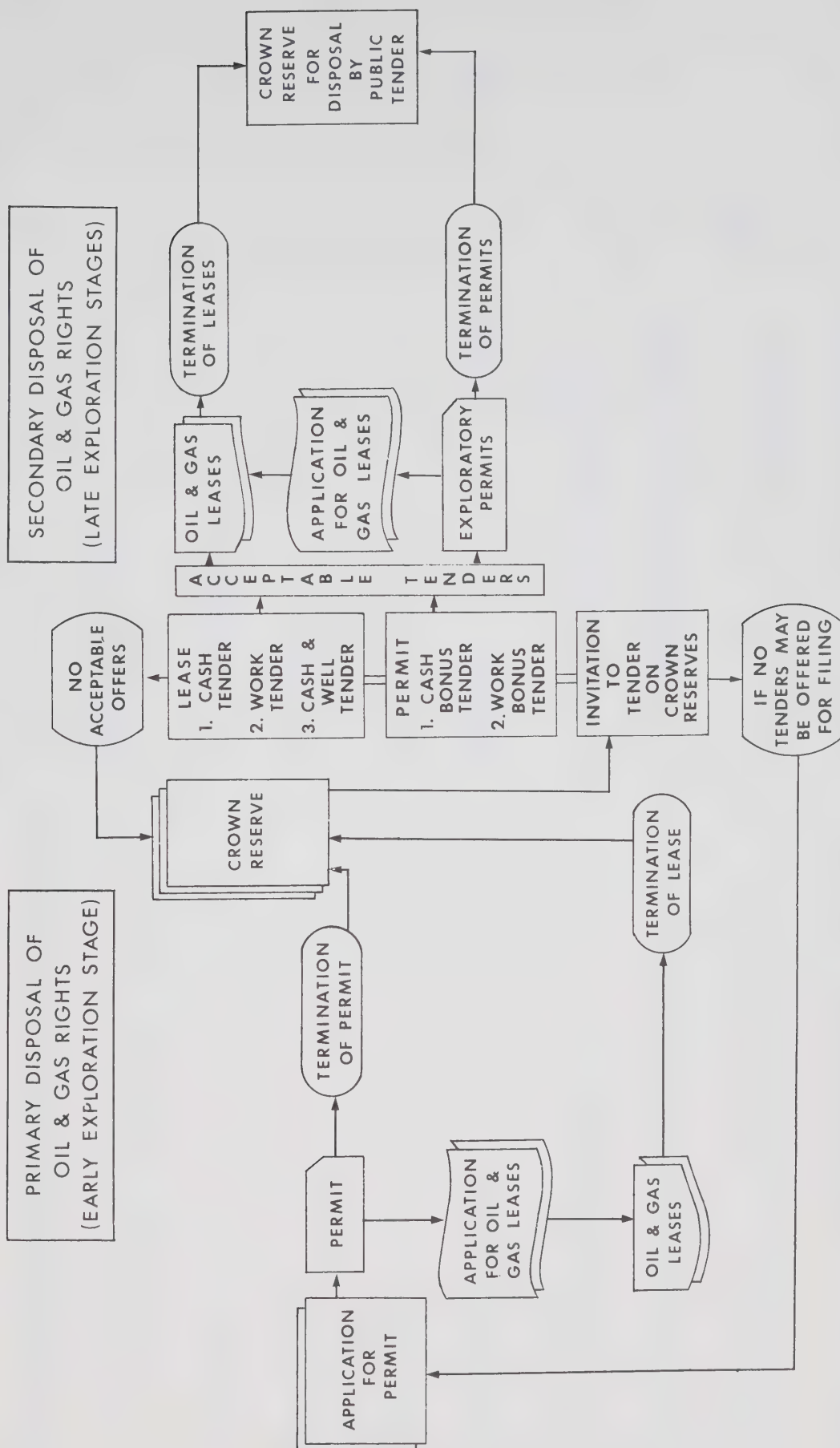


Fig. 7

OIL & GAS EXPLORATION EXPENDITURES

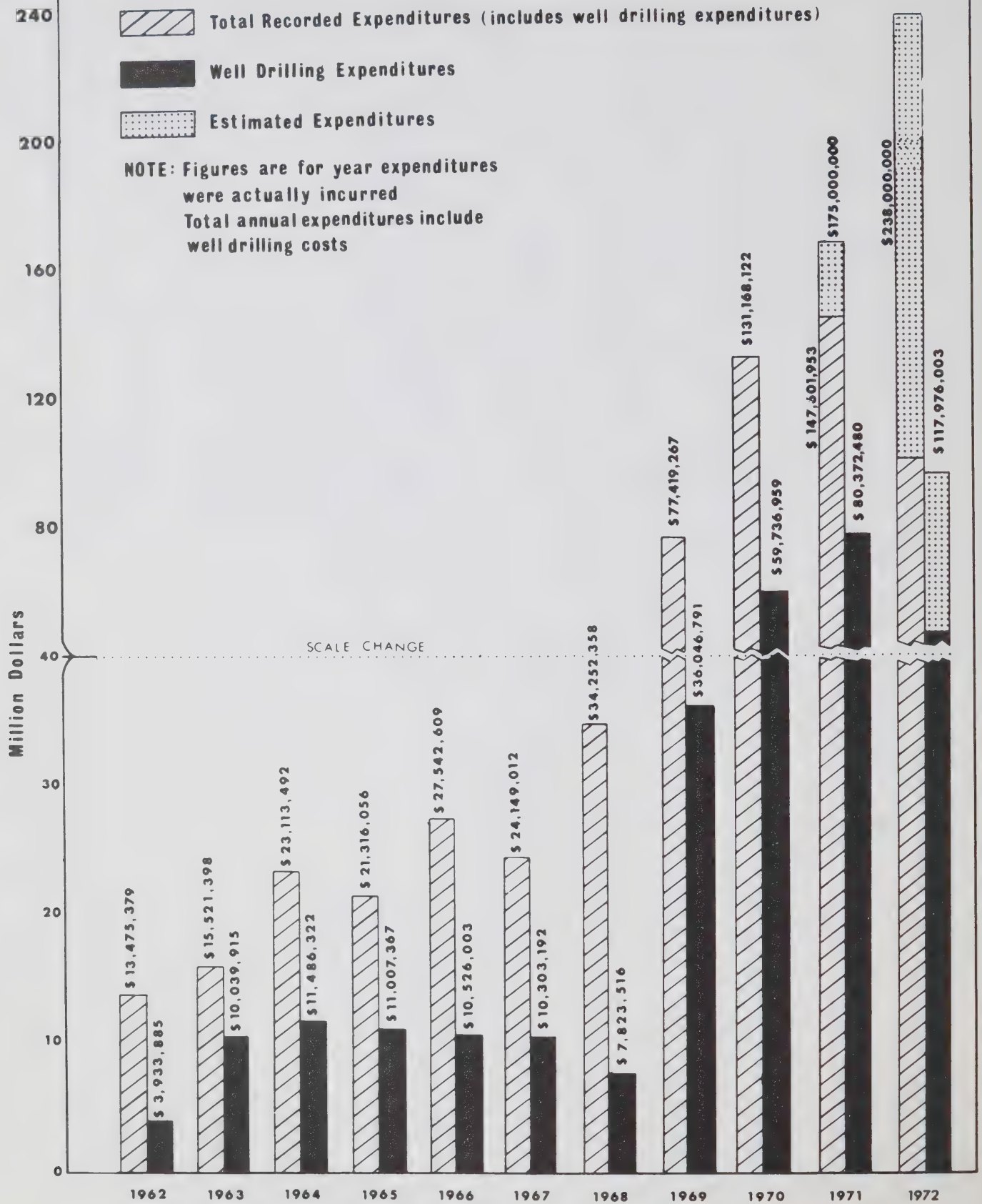


Fig. 8

EXPLORATION ACTIVITY

YUKON TERRITORY AND NORTHWEST TERRITORIES

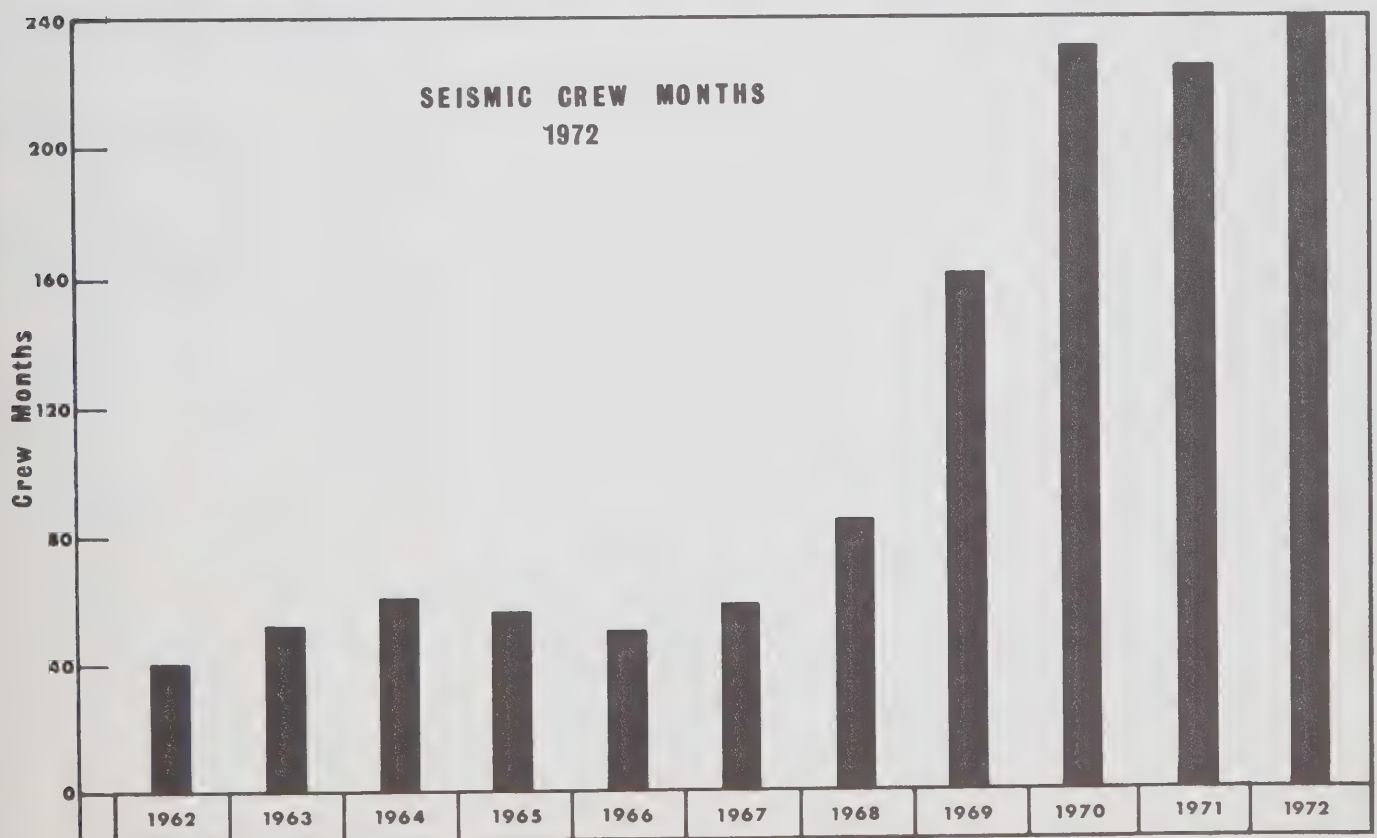
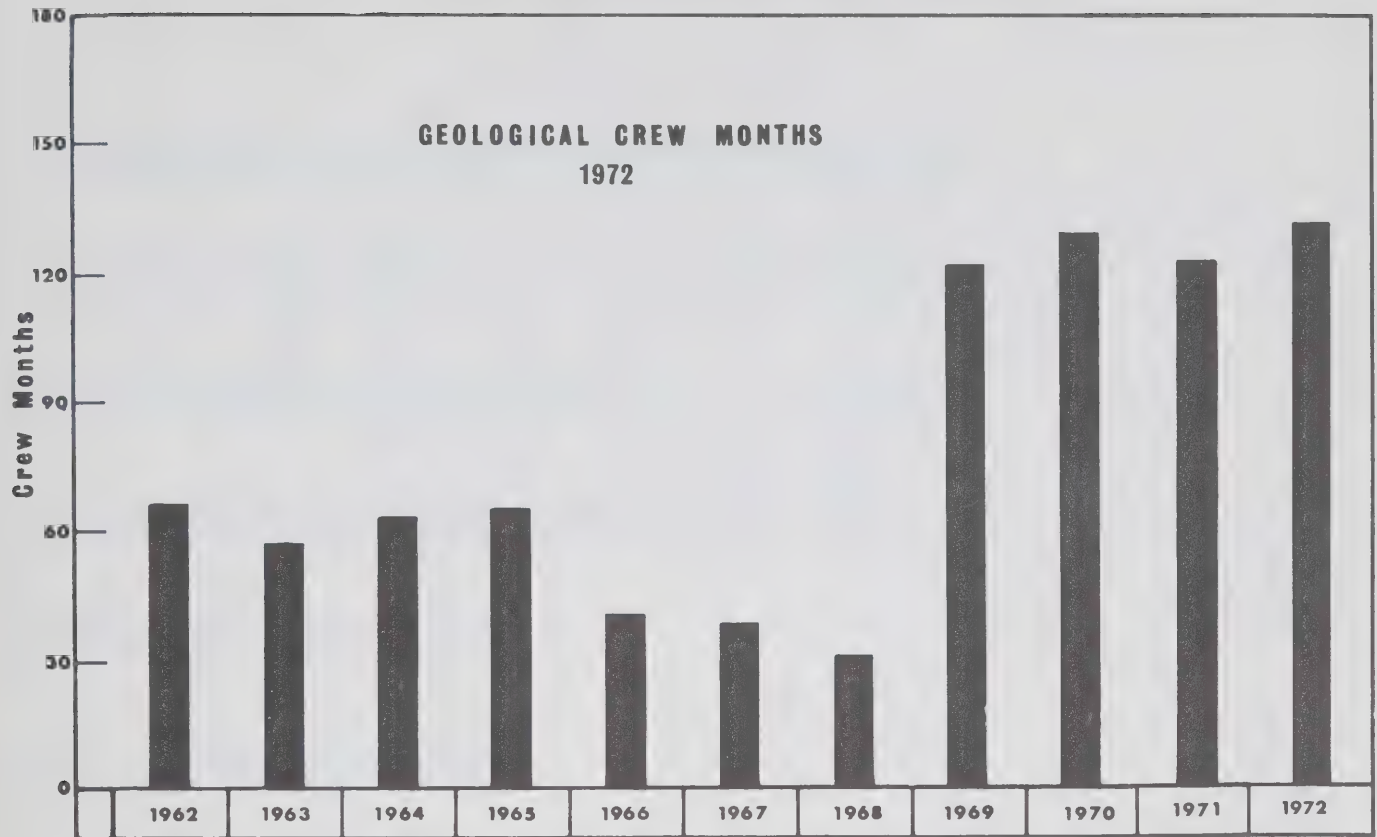


Fig. 9

WELLS DRILLED

YUKON TERRITORY - NORTHWEST TERRITORIES
Number of Wells Drilled to end 1972, 651

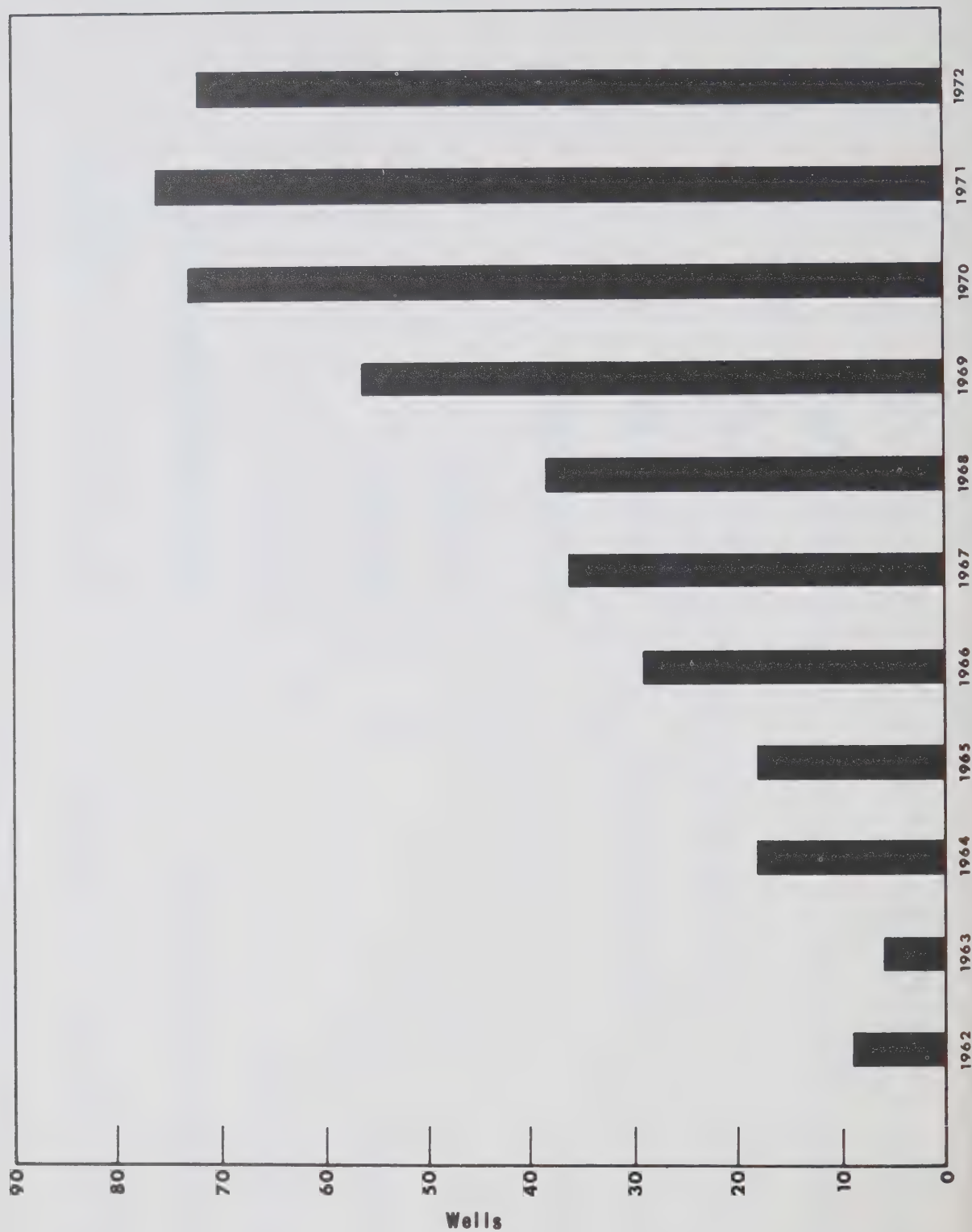
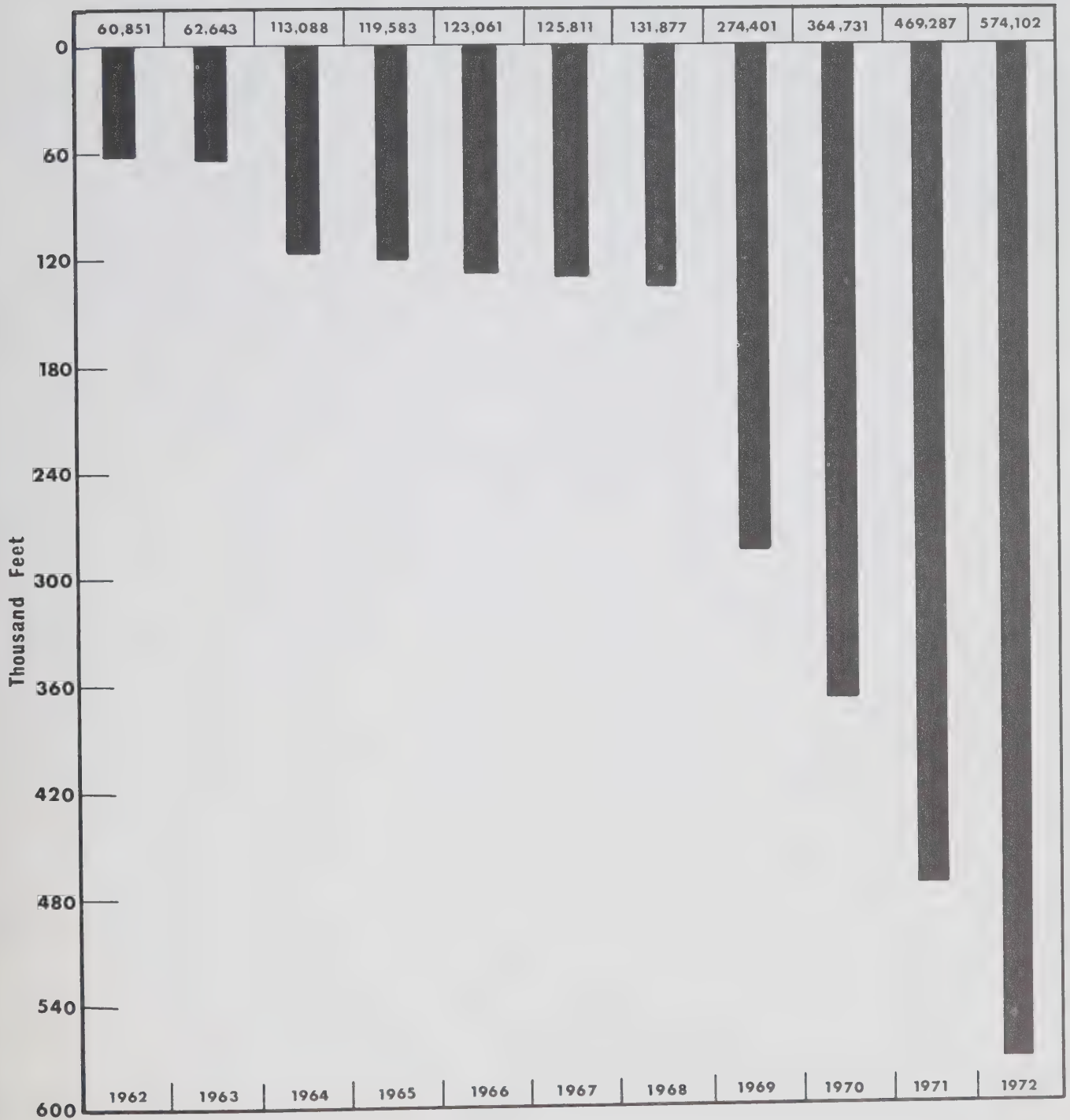


Fig. 10
FOOTAGE DRILLED
 YUKON TERRITORY AND NORTHWEST TERRITORIES



seismic participation programs were initiated in the Delta during the current season, participation being received from approximately 30 companies. In the Arctic Islands, major seismic programs were continued by Elf Oil Canada on Banks and Prince Patrick Islands while Panarctic Oils Ltd., Sunoco Company and Imperial Oil Ltd., utilizing approximately 10 seismic crews, continued large scale reflection seismic programs over most of the Arctic Islands.

Drilling activity was highlighted by large and extensive drilling programs in the Tuk-Delta area and Arctic Islands. In the Tuktoyaktuk area, Imperial Oil continued to drill stratigraphic and development tests. In June 1972, Imperial announced that its IOE Taglu C-42 and Mallik A-06 encountered gas in significant volume on tests. Gulf-Mobil made significant gas discoveries in their Parsons F-09 well and in their Kilagmiotak F-48 well. In the Arctic Islands, Panarctic Oils Ltd. drilled successful gas wells on Ellef Ringnes Island, Panarctic et al Kristoffer Bay B-06; on the Sabine Peninsula, a significant gas discovery was made in the Hecla F-62 well; extensions to the Drake Point Gas Field were made by successful completions in their Drake F-16 and B-44 wells. Panarctic also announced that oil flowed to surface from the 3,800 foot level in its Thor P-38 well.

In the Yukon Territory, Chevron Standard drilled and abandoned seven wildcat tests on the Eagle Plain without finding hydro-carbons. Additional wells by Inexco in the Eagle Plain and by Skelly and Pacific on the Peel Plateau failed to recover hydro-carbons.

The number of "wells drilled" and seismic "crew months" will increase during 1973. Extensive marine seismic programs will be carried out in the Beaufort Sea, in the Lancaster Sound and in the Baffin-Davis Straits areas. Reflection seismic activity also will increase in the Arctic Islands and in the Delta-Tuk areas. The continuation of wildcat drilling in the Arctic Islands by Panarctic Oils Ltd., Sunoco, and Dome Petroleum Limited, and the wildcat and development drilling in the area by the major companies, will increase the number of wells drilled to at least 90 in 1973. Drilling activity and seismic activity will maintain the same level in other areas and total exploration expenditures may exceed \$250 million in 1973. With the advent of major pipeline construction in the middle and late 70's, expenditures for oil activities in the north may approximate \$1 billion a year.

Drilling and Conservation Activities

Land Drilling Activities

Figures 9 and 10 graphically illustrate the drilling activities North of 60 in the calendar year 1972. The number of wells drilled in 1972 was less than the number drilled in 1971 but, the total footage drilled in 1972 increased by 22 per cent.

Approximately 95 per cent of the footage drilled in 1972 was exploratory drilling with 11 of the wells reporting discoveries of gas or oil out of 71 wells drilled. The development drilling carried out North of 60 was in the Pointed Mountain Gas Field.

The drilling rigs and production activities in the area were regularly inspected by conservation engineers to ensure safe

practice with due regard to conservation of oil and gas resources and adequate plans for possible contingencies such as oil spills.

Both industry and Government have a primary interest in preventing the accidental waste of resources, disturbance of the delicate subsurface thermal regime, or damage to the ecology. Close liaison was maintained between the Oil and Mineral Division and the oil and gas industry to ensure that drilling, completion and production activities were conducted safely and in accordance with modern advanced technology.

Offshore Drilling Activities

Departmental approval of drilling operations in the offshore regions of Canada's Arctic is necessary. Two proposals and a number of concepts for drilling offshore Canada's Arctic were reviewed and assessed during 1972. In this regard, the Department organized a two-day Northern Canada Offshore Drilling Conference, attended by over 180 senior representatives of Government and industry in December, 1972. Major aspects of the problems and a number of proposals were discussed in depth at the meeting.

The proceedings of the meeting and an information booklet documenting Government interfaces with industry in regard to drilling in the offshore regions of Canada's Arctic were prepared and distributed. A report on the major aspects of offshore drilling, with particular reference to Arctic offshore operations including an assessment and summary of the Departmental position on the two offshore drilling proposals presented to the Department, was initiated in 1972.

Approval was granted to Imperial Oil Limited to dredge an island called Immerk out of bottom sediments in the relatively shallow waters of the southern Beaufort Sea during the 1972 open-water period. Construction proceeded throughout the operating season. Immerk will be completed during the 1973 open-water operating season and it is anticipated that exploratory drilling will commence on the island in the third quarter of 1973.

Production Activities

The Pointed Mountain Gas Plant construction was completed for Amoco Canada in August 1972 and the three following wells went on stream to the plant during the year:

Pan Am Pointed Mountain K-45-60-30-123-45
Pan Am Pointed Mountain P-53-60-30-123-45
Pan Am Pointed Mountain O-46-60-30-123-45

Production from the Pointed Mountain Gas Field for 1972 averaged 94MMCF/day with total production of 11,731.78 MMCF for the year.

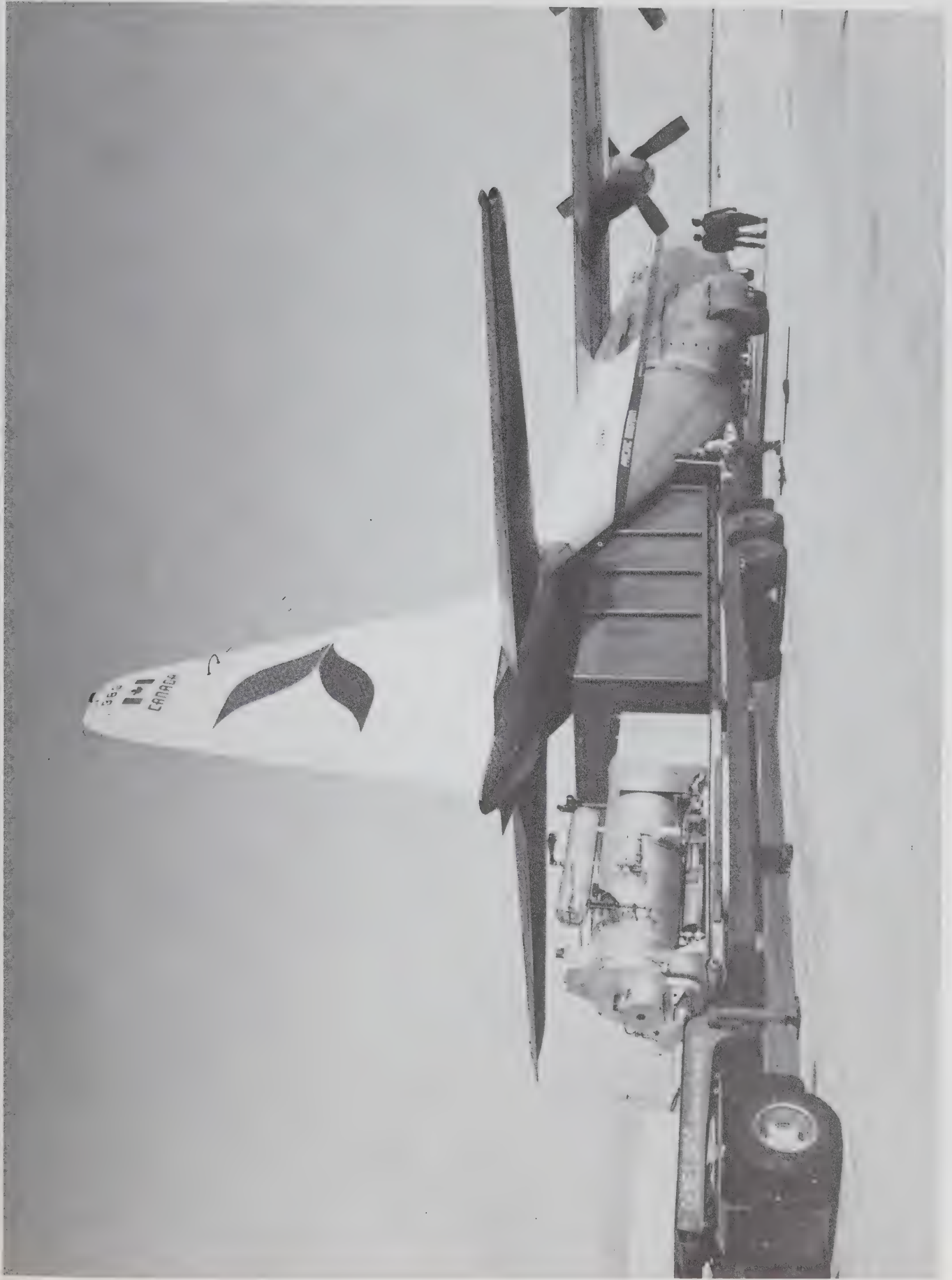
The Beaver River Gas Field straddles the Yukon Territory/British Columbia border and has one well, Pan Am Beaver River Y.T. G-01-60-10-124-15 North of 60. Production operations were unitized by an agreement signed between the Government of Canada and the Government of the Province of British Columbia on January 1, 1972. By agreement, 7% of the field production is assigned to the Yukon Territory portion of the field which totalled 2,613.7 MMCF in 1972.



Photograph No. 3 Empty tow Moving Upstream near Providence, N.W.T. (*Courtesy — Northern Transportation Co.*)



Photograph No. 4 Unloading Supplies at Gulf Oil Swimming Point Staging Area in Delta (Courtesy -
Northern Transportation Co.)



Photograph No. 5 Loading Equipment for Arctic Drilling Operations on Hercules (Courtesy — P.W.A.)



Photograph No. 6 Interior of Lockheed Electra Tanker 3,500 gallon Capacity (*Courtesy — P.W.A.*)



Photograph No. 7 Trials of the Voyageur Hovercraft (*Courtesy — Northern Transportation Co.*)



Photograph No. 8 Imperial Oil's Artificial Island in Beaufort Sea (Courtesy — Imperial Oil Ltd.)

Oil production North of 60 in 1972 was from the Norman Wells field. Production totalled 958,956 barrels of crude oil and 1,247.2 MMCF of natural gas.

Oil and Gas Drilling and Production Regulations

A joint project was initiated by the Department of Energy, Mines and Resources and the Department of Indian Affairs and Northern Development in 1972 to update the Canada Oil and Gas Drilling and Production Regulations to regulate all aspects of drilling, development, production, conservation, and safety in oil and gas operations on Canada lands.

Participation and Research Projects

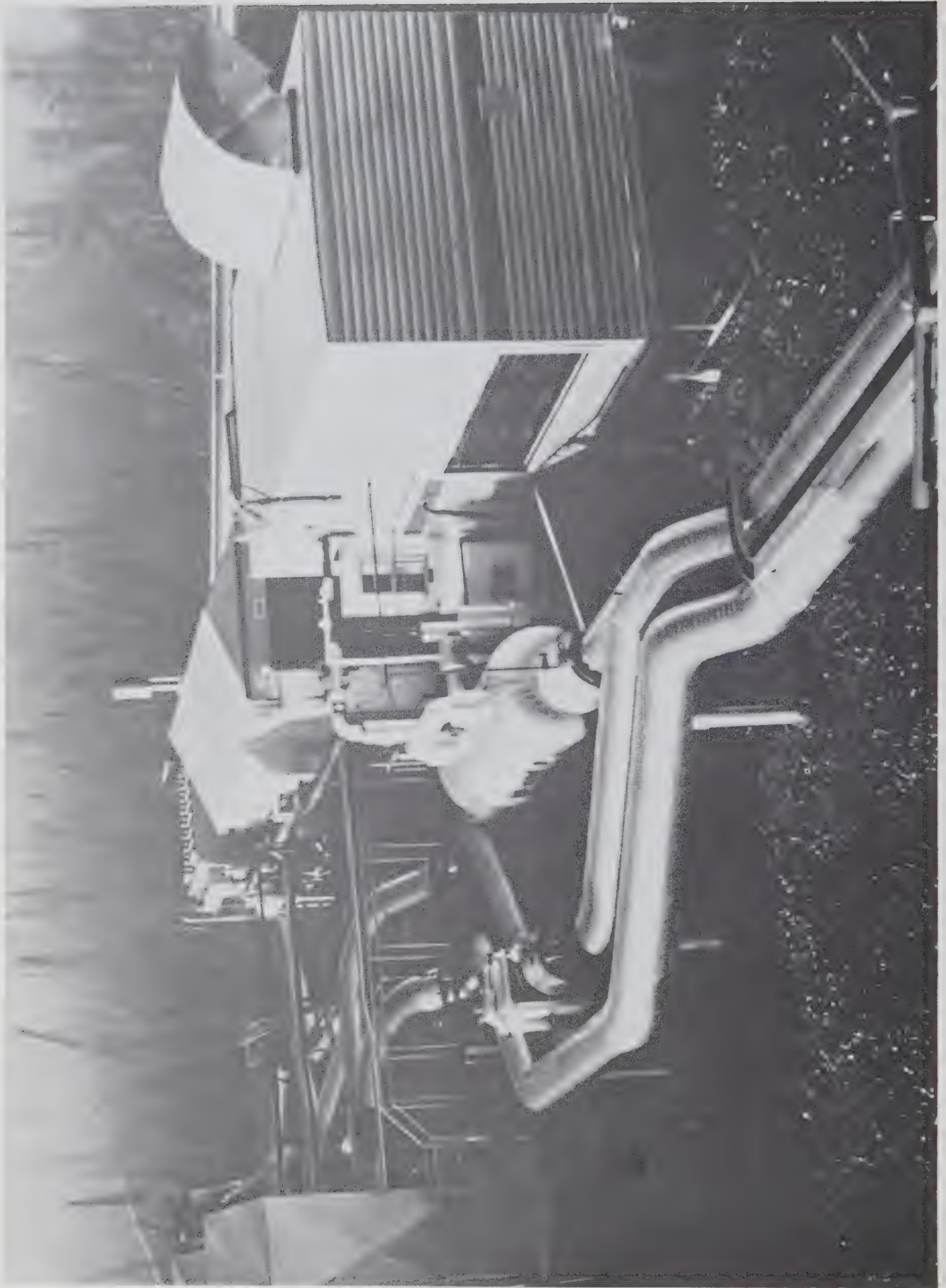
Approximately 53 participation and research-type projects were initiated or continued during 1972. This is in addition to APOA programs. Expenditures incurred for these projects qualify for work credits and when approved can be applied to permits in approved designated areas. Major programs in these categories in 1972 were:

1. *Polarquest* is a three-year program of reconnaissance surveys in the Arctic and surrounding waters. Programs in 1972 consisted of ten marine seismic programs in the inter-islands areas of the east Sverdrup Basin and in the Parry Channel. Due to extensive heavy ice-coverage many of the seismic programs were modified or abbreviated.
2. *Sigma Seismic Programs* — Sigma Geophysical Limited carried out three large reconnaissance seismic programs. One was in the area of Colville Lake between latitude 66° to 70° east of the Mackenzie River. The second program was centered between latitude 64° and 69° along the Mackenzie River and west of the River in the Delta. The third program consisted of a single reflection line joining the major oil and gas discoveries in the Sverdrup Basin. This will provide information on a regional basis in the assessment of geological framework in the Sverdrup Basin. The permittees acquiring this information by the purchase of data may apply their expenditures on permits encompassed by the area covered by the surveys.
3. *Eureka Explorations Limited* — the company carried out three large reconnaissance marine seismic programs. One encompassed the sedimentary area in the Davis Strait — Baffin Bay areas; the second marine program was in the Lancaster Sound and Parry Channel. The third program was a combined land and water seismic survey shot over the ice in the Delta.
4. *Phoenix Ventures Programs* — carried out three large land and marine seismic programs along the Arctic Coastal Plain, Mackenzie Bay and Delta and Sverdrup Basin. Total cost of the programs is estimated to be \$5 million. Permittees acquiring this information by the purchase of data may apply their expenditures to permits in the general Mackenzie Bay, Beaufort Sea and Sverdrup Basin areas.
5. *Arctic Petroleum Operators Association* — The Association is composed of 24 oil companies who hold permits in the Beaufort Sea area. The objectives are to develop the necessary operating technology for the Arctic to engage in studies related to ecological and conservation programs and to act as liaison between other research agencies relative to

Arctic and Beaufort Sea operations. Since its inception in January 1970, 57 APOA projects have been completed or are currently under way. The total cost of the projects is approximately \$3.2 million. Some of the major programs in 1972 were:

- a) Ice-thickness measurement.
- b) To measure magnitude, direction and rate of movement of the near shore ice in the Mackenzie Delta area of the south Beaufort. In addition to ice movement, measurements are also made of wind-speed and direction, ice temperatures, air temperature and tidal state.
- c) To establish a crushing strength of ice.
- d) To acquire a better knowledge of the size and distribution of ice-islands from year to year to help in decisions concerning methods of exploration and development in the off-shore provinces.

In 1973 the ice, weather, sea state, and data gathering and processing program will be initiated. The objective of the program is to predict ice movements and coverage, gather information on micro-weather, on sea state and for developing techniques to accurately predict its position such as the rig location in the Beaufort Sea. The total cost of this program is estimated at \$550,000.



Photograph No. 9 Compressor and Refrigerator Units of Pipeline Testing Facility at Sans Sault, N.W.T.
(Courtesy - Canadian Arctic Gas Study Ltd.).



Photograph No. 10 Mackenzie Delta – Area of Extensive Drilling, Seismic and Pipeline Testing Operations (*Courtesy – Canadian Arctic Gas Study Ltd.*)



Photograph No. 11 Gas Flow tests on the Panarctic et al Hecla F-62 well. (Courtesy -- Panarctic Oils Ltd.)

Exploration—Items of Interest

Oil and Gas Production and Conservation Act

The need for an Oil and Gas Production and Conservation Act to provide statutory authority for control of oil and gas production, prevention of waste and safety of operations in the North was recognized in the Oil and Gas Production and Conservation Act that became law on June 27, 1969. This Act, confined initially to the Yukon and Northwest Territories was extended to cover all of Canada outside of the provinces on June 11, 1970.

Regulations pursuant to this Act are in the initial stages of drafting.

Land Use Regulations

In June, 1970, amendments to the Territorial Lands Act were passed by Parliament and these permit the implementation of Territorial Land Use Regulations. The Regulations were promulgated on November 4, 1971.

The Regulations provide authority for designating Land Management Zones in the Yukon Territory and Northwest Territories. Within these zone all resource exploration and development operations will be required to take out Land Use permits. The Land Use permits will stipulate the required measures to be followed by the operator to protect and prevent unnecessary disturbance of the affected terrain and ecosystems.

The Land Use Regulations are being administered in the Northwest Territories by the Regional Director of Resources and his staff in Yellowknife; in the Yukon Territory the Regulations are administered by the Regional Director of Resources and his staff in Whitehorse. Exploration programs carried out on all offshore areas contiguous to the Northwest Territories are monitored by the Regional Director of Resources in Yellowknife.

1972 Pipeline Guidelines

The Government made known its current views on expanded guidelines for the construction and operation of oil and gas pipelines in the Yukon Territory and the Northwest Territories. The proposed guidelines deal with the corridor concept, the environment and social implications, and are a further elaboration of those announced in August, 1970, by the Minister of Energy, Mines and Resources and the Minister of Indian Affairs and Northern Development.

The Government's purpose in expressing these latest views is to give further guidance to industries engaged in research and

planning in connection with northern pipelines and to afford the opportunity to northern residents, and all others concerned to make observations on the guidelines proposed.

In particular, the Government is ready to sit down with the representatives of the native peoples involved, invite their views on the guidelines proposed, and reflect these views wherever possible.

It is the Government's intention, after making any such modifications, to bring these expanded guidelines into force on or about December 31, 1972.

Copies of the Pipeline Guidelines may be acquired from the Chief, Oil and Mineral Division, Department of Indian Affairs and Northern Development.

Northern Pipelines Research Projects

Over \$60 million has now been committed to studies aimed at preserving the environment of the areas which will be crossed by pipelines carrying oil and gas from Northern Canada.

Gas Arctic — Northwest Project Study Group

An organization formed of Canadian and United States gas and transportation companies with an interest in moving northern gas to energy markets. The participants are: The Alberta Gas Trunk Line Company Limited, Canadian National Railway Company, the Columbian Gas System Inc., Northern Natural Gas Company, Texas Eastern Transmission Corporation, Imperial Oil Limited, Atlantic Richfield, Humble Oil & Refining Co., Standard Oil Co. (Ohio), TransCanada, Michigan Wisconsin Pipe Line Co., and Natural Gas Pipe Line Co. of America. The group is operating two programs on one site at Sans Sault Rapids, 65 miles northwest of Norman Wells, N.W.T.

The Company has also announced a program of research into the problems of laying a pipeline across the channels between the Arctic Islands.

The consortium is studying a gas pipeline from Alaska and the Mackenzie Delta to southern markets. The group has formed Canadian Arctic Gas Study Limited to complete the feasibility of a gas pipeline from the Arctic and to develop a pipeline permit application. Another company, Canadian Arctic Gas Pipe Line Limited, will make the permit application and, if it is granted, build the line in Canada. At the end of 1972, 25 companies were members of the consortium.



OIL AND GAS FIELDS AND DISCOVERIES

YUKON TERRITORY

- 1 Beaver River Gas Field
- 2 Chance Gas Field
- 3 Socony Mobil et al Blackie No.1
- 4 Socony Mobil et al Birch Y.T. B-34

NORTHWEST TERRITORIES

- 5 Pointed Mountain Gas Field
- 6 Rabbit Lake Gas Field
- 7 C.P.O.G. et al LaBiche F-08
- 8 H.B. Cameron Hill A-05
- 9 S. Island River Gas Field
- 10 Home Signal Celibeta H-78
- 11 Shell H.B. Grumbler G-63
- 12 Sun Netla C-07
- 13 Texaco Bovie Lake J-72
- 14 Union Pan Am. Trainer Lake C-39
- 15 Pacific Amoco Tathlina N-18
- 16 Norman Wells Oil Field
- 17 Taglu Gas Field
- 18 Gulf Mobil Parsons F-09
- 19 Gulf Imperial Shell Titalik K-26
- 20 Gulf Imperial Shell Reindeer F-36
- 21 Gulf Mobil Ya Ya P-53
- 22 Shell Niglintgak H-30
- 23 Imperial I.O.E. Mallik L-38
- 24 Imperial Ivik J-26
- 25 I.O.E. Mayogiak J-17
- 26 I.O.E. Atkinson H-25

ARCTIC ISLANDS

- 27 Drake Point Gas Field
- 28 Hecla Gas Field
- 29 King Christian Gas Field
- 30 Panarctic Tenneco et al Kristoffer Bay B-06
- 31 Dome Arctic Ventures Wallis K-62
- 32 Thor Gas Field
- 33 Panarctic Romulus C-42



LEGEND

- Product Pipeline
- Westcoast Transmission Gas Pipeline
- M.O.T. & Territorial Govt. Airports
- ▲ Oil Refinery, Gas Plant
- Green Indicates Oil Well or Oil Field
- Red Indicates Gas Well or Gas Field



Imperial Builds Artificial Island in Beaufort Sea

Imperial completed the construction of one artificial island, Immerk (69° 36' — 135° 08'), in the shallow waters of Mackenzie Delta using dredged material from the sea bottom. Costing \$3 million to date, the island is, in essence, an experimental drilling platform. If it stands up over the winter and summer, drilling will be started there in late 1973.

Elf Oil Forms Group to Explore in Western Sector — Arctic Islands

Elf Oil Exploration and Production Canada Ltd. announced that Elf Canada has entered into a partnership agreement with the following group of companies — Tenneco Oil & Minerals Ltd., Columbia Gas Development of Canada Ltd. (a subsidiary of Northern Natural Gas Company, Inc.), Texas Eastern Exploration of Canada Ltd., Norlands Petroleum Limited (a subsidiary of Northern Natural Gas Company) and Panarctic Oils Ltd. for the purpose of carrying out exploration programs on a portion of Elf Canada's holdings in the Canadian Western Arctic (Banks, Prince Patrick and Borden Islands and adjacent offshore).

Under the terms of the partnership agreement, Elf is to contribute up to approximately 11.8 million net acres of its holdings in the Canadian Western Arctic (of which approximately 2.6 million net acres are offshore) to the partnership, which is to be known as ELFEX & Co. The group of companies has agreed to contribute for exploration up to 40 million dollars in a first period and three subsequent optional periods of approximately two years commencing January 1, 1973, and ending December 31, 1979.

The contributions of the group of companies are to be used by the partnership to carry out exploration activities on the lands contributed to the partnership by Elf Canada and on other lands that may be subsequently acquired by the partnership. In return the group of companies will receive up to a 31-1/2% interest in the partnership.

Under the terms of the partnership agreement, the group companies will provide upon the request of Elf Canada, and based upon the periods involved, up to 20 million dollars to the partnership for use in drilling wells to delineate any gas discoveries made by the partnership. In addition, the group of companies will provide at the request of Elf Canada, up to 75 million dollars for use in drilling gas development wells.

The gas companies will receive priority to negotiate the purchase of any gas developed by the partnership on partnership lands at prices and on terms satisfactory to Elf Canada, having regard to then existing markets.

Dome Planning Twelve Wells in Arctic Islands Drilling Program

An agreement has been reached in principle with Consolidated Gas Supply Corporation of Pittsburg, Texas Gas Exploration Limited and Panhandle Eastern Pipe Line Company of Houston whereby these three companies will spend a minimum of \$30 million in exploratory drilling over a five-year period on Dome lands in the Canadian Arctic Islands commencing in the fall of 1972. Dome will operate the programs and will also carry out, at its own expense, geological and geophysical surveys necessary to delineate drillable structures.

Dome Petroleum is programmed to drill 12 holes this year and next on the 7.5 million gross acre spread it holds in the Arctic Islands.

Two wells are planned for Melville Island, on Dundas and Sabine Peninsulas. The other 10 will all be in the middle part of Sverdrup Basin. Three are to be on King Christian Island, on a separate structure west of Panarctic Oils' big gas discovery, two on southern Ellef Ringnes Island and two more on the western part of the same island. East of Ellef Ringnes Island one more hole is planned on Haig Thomas Island, and the remaining two will test the northern margin of Sverdrup Basin on Meighen Island.

On King Christian, additional seismic will pinpoint drill sites on structures already outlined by reconnaissance seismic and gravity surveys conducted last year. Further seismic is planned this year on Meighen, Ellef Ringnes, Amund Ringnes, Haig-Thomas and Melville Islands. The rig Dome contracted from Gustavson Drilling was shipped to King Christian in the fall and is destined to work for Dome on a continuous basis on its multi-hole program.

New Seismic Craft being Utilized in Beaufort Sea

Two new craft carried out seismic surveys in the Beaufort Sea last year, operating in extremely shallow waters along the shoreline outside the Mackenzie Delta.

In the western fringes of the Delta, near Tent Island, Pan Canadian Petroleum utilized a SRN-6 air cushion vehicle in an area where maximum water depth is only eight feet.

PanCanadian's contractor, Seismograph Service Corp., utilized a standard ACV with the only special equipment being proper seismic instrumentation. Timing for the 200-mile survey was strictly regulated by the birds, since this general area is near a bird sanctuary. Two periods remain open. The various times of restrictions are dictated by nesting seasons of various bird species during which surveys can be done in accordance with ecological considerations.

Energy source was primer cord in the water, which will not, when fired, scour the bottom. Reception was through a 24-station floating cable. The survey procedure calls for the cushion craft to move to a shotpoint, throttle down, remain stationary, fire and move on the next shot point.

Geophysical Service Inc. (GSI) have a new Canadian flag vessel, the MV Mariner. This vessel was designed for Arctic Work.

GSI's 100-foot Mariner was outfitted with seismic equipment at Hay River, where it was assembled and launched after being trucked up from its Edmonton builders.

Arctic Transportation Companies Formed

A new Canadian company, Arctic Transportation Ltd. of Vancouver will offer specialized transportation service to the Western Arctic. Two major Canadian marine transportation firms, Seaspan International Ltd. of Vancouver and Federal Commerce and Navigation Co. of Montreal, were responsible for the formation of the transportation consortium.

The unusual difficulties and demands related to transportation in the Arctic dictated the formation of the company, which brings together the equipment and expertise of three established towing companies and a world-wide steamship company. In addition to the Canadian companies, there will be participation of Puget Sound Tug & Barge Company and PAC, both of Seattle, Washington, bringing together virtually all of the experience and expertise that has been developed in this specialized field in the past 15 years.

The oil and gas play at Prudhoe Bay and elsewhere along Alaska's North Slope and the Canadian Western Arctic provided the incentive for the formation of Arctic Transportation Ltd. The company is prepared to provide specialized transportation requirements along the Western Arctic coastline.

A second transportation company, Arctic Navigation and Transportation Ltd. was formed by Trimac Ltd. of Calgary and Rivtow Straits Ltd. of Vancouver. This new company plans to operate tugs and barges in the Arctic Ocean and on the Mackenzie River.

APOA to spend \$1.5 Million in 1973

The Arctic Petroleum Operators' Association plans to spend \$1.5 million on its 1973 programs, which will be heavily concentrated on activities directly related to far north operations.

APOA continues to have representation on the Advisory Committee for Arctic Land Use Research Program, and has financially and logistically supported projects conducted by the University of Alberta and other universities throughout Canada and in the Mackenzie Delta area.

In addition, in the Delta support was made available for studies undertaken by the university of Alberta to determine the rehabilitation by natural and induced methods in disturbed areas within the impact use of vehicles on the terrain.

Under the International Biological Program, APOA was also involved in the Devon Island project with a multi-disciplinary study of the high Arctic tundra ecosystems.

The Operators Guide Booklet was distributed to members of the Association and to Government personnel. The booklet will also be available in the near future to any other interested parties at a cost of \$25 a copy. In addition, as a gesture of international co-operation, the drilling sub-committee of the APOA will make copies of the booklet available to their counterparts in the Canadian-Soviet mixed commission for exchange of general technology in oil and gas fields of development.

APOA sponsored among its 34 member companies a total of 16 projects in 1973 at a cost of one million dollars. The 1973 program budget will exceed two million dollars to finance a number of continuing programs, including ice studies, polar ice movements, further frontier exploration research, environmental research studies, oil spill studies and offshore operations.

The Association does not itself carry out research work. It acts as a clearing house for proposals and determines membership interest in participating in various projects.

Arctic Gas Pipeline Group Formed

A group composed of TransCanada Pipelines Limited, Panarctic Oils Ltd., Canadian Pacific Investments Limited and Tenneco Oil and Minerals Ltd., announced an agreement for the conduct of appropriate research investigations and planning for a project to build a natural gas pipeline from the Canadian Arctic Islands. The undertaking will be known as the "Polar Gas Project". TransCanada Pipelines will manage the project, and the expertise will be provided from the staff of the participating companies. The four companies bring to the group a wealth of knowledge and experience in gas pipeline transmission, in transportation in general and in Arctic operations. The research, engineering and planning to be undertaken started with the preliminary route reconnaissance survey conducted last year under the direction of Panarctic Oils Ltd. At that time, two routes were surveyed, one passing to the west side of Hudson Bay and the other passing to the east side.

The participants in the Polar Gas Project plan to budget substantial funds for 1973 for more studies and surveys of these two routes and for studies of the underwater crossings required to gather the gas from the various Arctic Islands to the Boothia Peninsula on the Canadian mainland.

The work scheduled for 1973 will involve environmental studies to be conducted by consultants, along with engineering work such as ice investigations, aerial photography, on-the-ground surveys, soil samplings, permafrost evaluation and mapping. Special efforts will be devoted to marine surveys of Arctic Island water crossings, including studies of necessary equipment required to construct such installations.

F.F. Slaney and Co. Ltd., Vancouver, has been awarded a contract for the first phase, which will isolate problem areas requiring detailed investigation. They will utilize the services of Tremblay, Herous and Assoc. for the Quebec part of the investigation. There will be continuing consultation with communities on both routes to determine their views on possible social-environmental problems.

Gas supplies for the Polar Gas Project will be based on gas discoveries made by Panarctic Oils at Hecla and Drake Point on the Sabine Peninsula of Melville Island, at King Christian Island and Kristoffer Bay on Ellef Ringnes Island. Last year, Panarctic announced that it has discovered about one-third of the threshold gas reserve required to support a gas line project and that the full reserve could be expected in about two more years if the discovery success ratio of the past is maintained. In addition, and encouraged by Panarctic successes, other companies are actively exploring in the Arctic Islands and it is reasonable to expect other successes by these companies.

Revenues

While no sales of oil and gas rights were held in 1972, revenues governing the Northern operations during the calendar year approximated \$5.3 million. (See Table 5 and Figure 12). Revenues from all sources for the fiscal year are shown in Table No. 4 and Figure No. 11. Figure 13 depicts the annual value of work bonus for oil and gas work bonus blocks and permits. Cumulative value of work bonus to the end of 1971 is approximately 59 million dollars.

Table 4 — Gross Revenue Oil and Gas (By Fiscal Year)

NORTHWEST TERRITORIES

Fiscal Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	Total
1968-69	2,675.00	932,750.00	49,715.00	1,090.00	1,576,734.76	35,092.00	374,468.96	5,574,369.85	1,966.60	8,548,862.17
1969-70	3,800.00	391,692.70	59,080.00	2,240.00	2,093,730.05	19,630.00	19,852.44	—	2,296.10	2,592,321.29
1970-71	5,800.00	101,508.60	60,921.52	1,450.00	3,396,332.82	244,072.00	729,500.39	—	1,930.17	4,541,515.50
1971-72	5,550.00	400,000.00	52,105.00	1,110.00	4,182,655.72(1)	301,562.00	476,328.66	—	1,848.71	5,421,160.09
1972-73	2,550.00	234,500.00	41,965.00	3,200.00	4,493,538.70(2)	165,344.00	384,624.03	—	553.27	5,326,275.00
TOTAL	20,375.00	2,060,451.30	263,786.52	9,090.00	15,742,992.05	765,700.00	1,984,774.48	5,574,369.85	8,594.85	26,430,134.05

(1) Permit Renewals (Rental) — Special (\$1,607,455.50)

(2) Permit Renewals (Rental) — Special (\$1,163,492.75)

YUKON TERRITORY

1968-69	—	82,000.00	875.00	330.00	27,939.25	—	7,845.90	936,526.37	—	1,055,516.52
1969-70	—	10,250.00	—	—	30,749.50	—	—	—	—	40,999.50
1970-71	—	4,750.00	25.00	190.00	364,604.75	—	41,306.56	—	—	410,876.31
1971-72	—	—	410.00	85.00	120,688.25(3)	11,036.23	—	—	—	132,219.48
1972-73	—	750.00	—	2,950.00	458,756.50	25,750.74	—	—	—	488,207.24
TOTAL	—	97,750.00	1,310.00	3,555.00	1,002,738.25	36,786.97	49,152.46	936,526.37	—	2,127,819.05

(3) Permit Renewals (Rental) — Special (\$24,960.00)

GRAND TOTAL REVENUES

1968-69	9,604,378.69
1969-70	2,633,320.79
1970-71	4,952,991.81
1971-72	5,553,379.57
1972-73	5,814,482.24
TOTAL	28,558,553.10

Table 5 — Gross Revenue Oil and Gas (By Calendar Year)

Northwest Territories

Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	Total
1968	2,298.18	652,800.00	32,780.00	1,830.00	1,405,916.76	35,092.00	394,254.08	2,871,080.66	1,702.07	5,397,753.75
1969	2,000.00	320,701.30	45,540.00	1,290.00	1,404,600.82	19,630.00	19,852.44	3,043,711.52	1,700.73	4,859,026.81
1970	5,175.00	141,250.00	56,350.00	1,960.00	3,315,524.09	244,072.00	661,828.60	—	2,285.69	4,428,445.38
1971	4,900.00	395,500.00	55,806.52	1,130.00	4,070,722.82(1)	301,562.00	478,609.95	—	1,681.03	5,309,912.32
1972	4,525.00	231,500.00	37,795.00	3,150.00	4,136,291.41(2)	148,579.96	251,701.28	—	1,077.27	4,814,619.92
Total	18,898.18	1,741,751.30	228,271.52	9,360.00	14,333,055.90	748,935.96	1,806,246.35	5,914,792.18	8,446.79	24,809,758.18

(1) Permit Rental — Special Renewals (\$1,528,189.50)

(2) Permit Rental — Special Renewals (\$1,002,534.75)

Yukon Territory

1968	—	86,750.00	875.00	330.00	27,939.25	—	147,680.76	248,615.66	—	512,190.67
1969	—	8,500.00	—	—	30,749.50	—	—	671,306.75	—	710,556.25
1970	—	1,750.00	—	140.00	182,448.00	—	29,349.60	—	—	213,687.60
1971	—	4,750.00	360.00	275.00	423,944.50(3)	4,660.40	41,506.56	—	—	475,496.46
1972	—	750.00	75.00	2,950.00	507,079.00	20,536.53	—	—	—	531,390.53
Total	—	102,500.00	1,310.00	3,695.00	1,172,160.25	25,196.93	218,536.92	919,922.41	—	2,443,321.51

(3) Permit Rental — Special Renewals (\$24,960.00)

Grand Total Revenues

1968	5,909,944.42
1969	5,569,583.06
1970	4,642,132.98
1971	5,785,408.78
1972	5,346,010.45
Total	27,253,079.69

Fig. 11

YUKON TERRITORY-NORTHWEST TERRITORIES
GROSS REVENUE-OIL & GAS
FROM
CASH BONUS BIDS, FEES, FORFEITURES
ROYALTIES, RENTALS & SALE OF MAPS

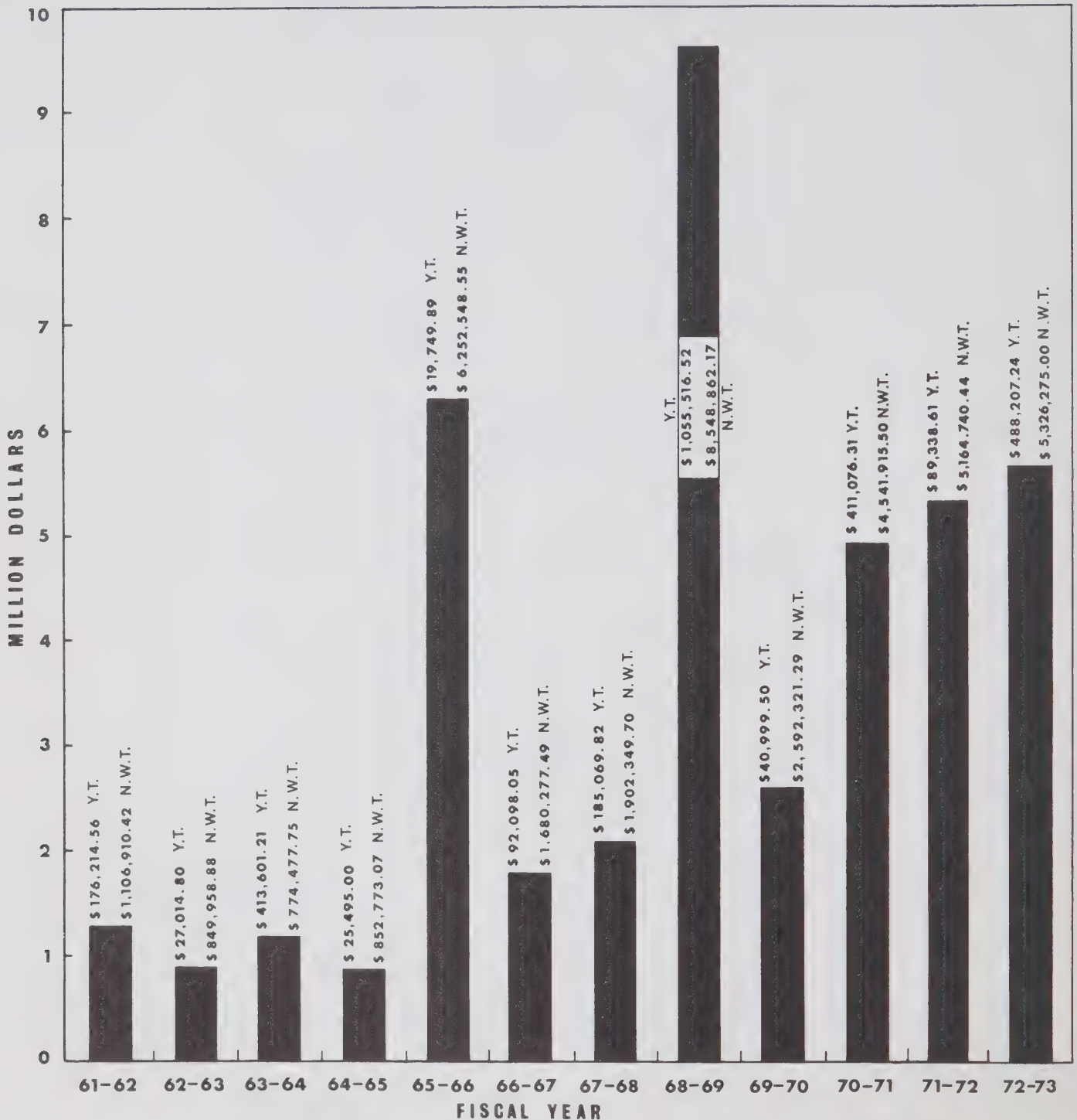


Fig. 12

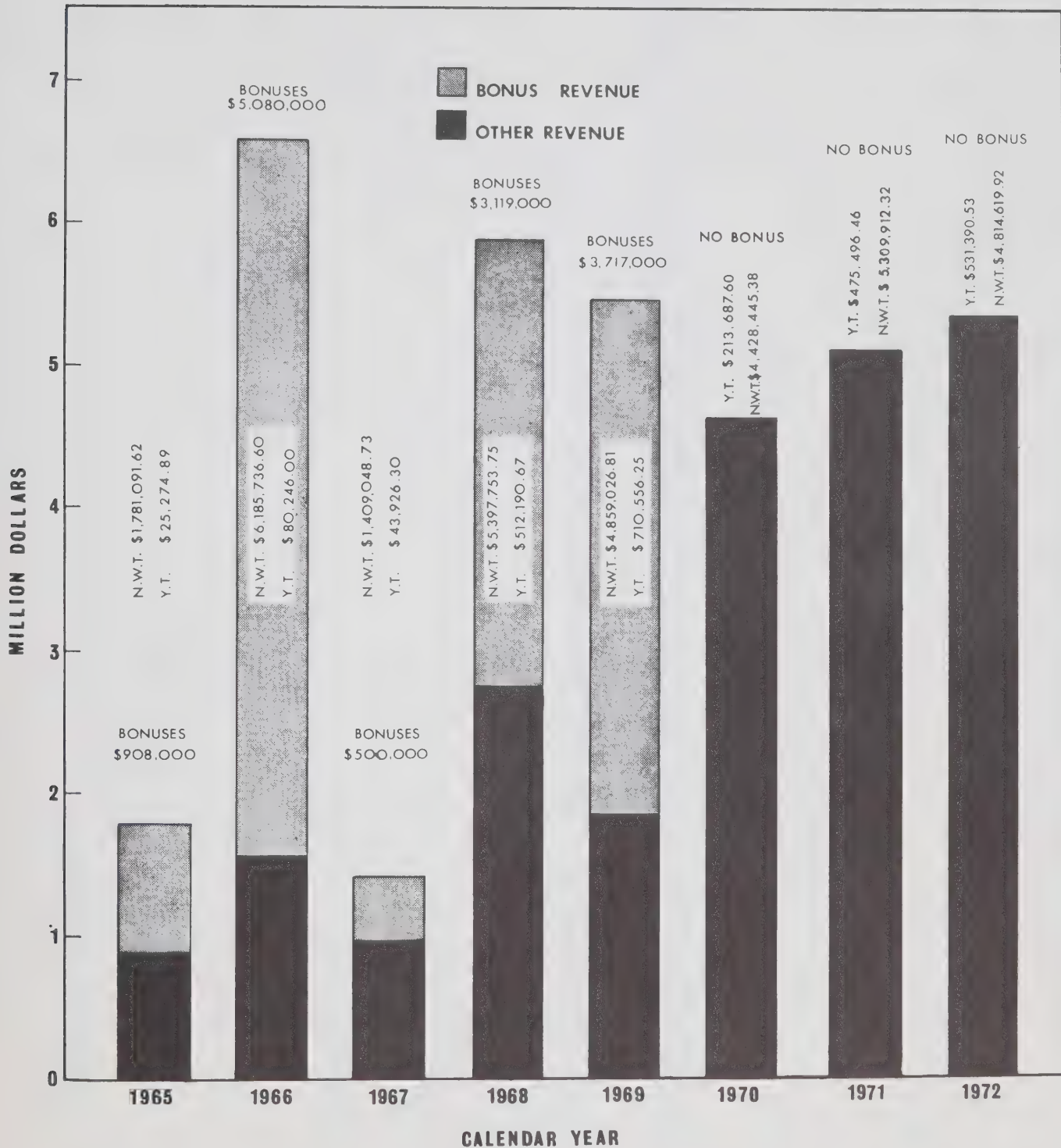
YUKON TERRITORY - NORTHWEST TERRITORIES

GROSS REVENUE-OIL & GAS

FROM

CASH BONUS BIDS, FEES, FORFEITURES

ROYALTIES, RENTALS & SALE OF MAPS



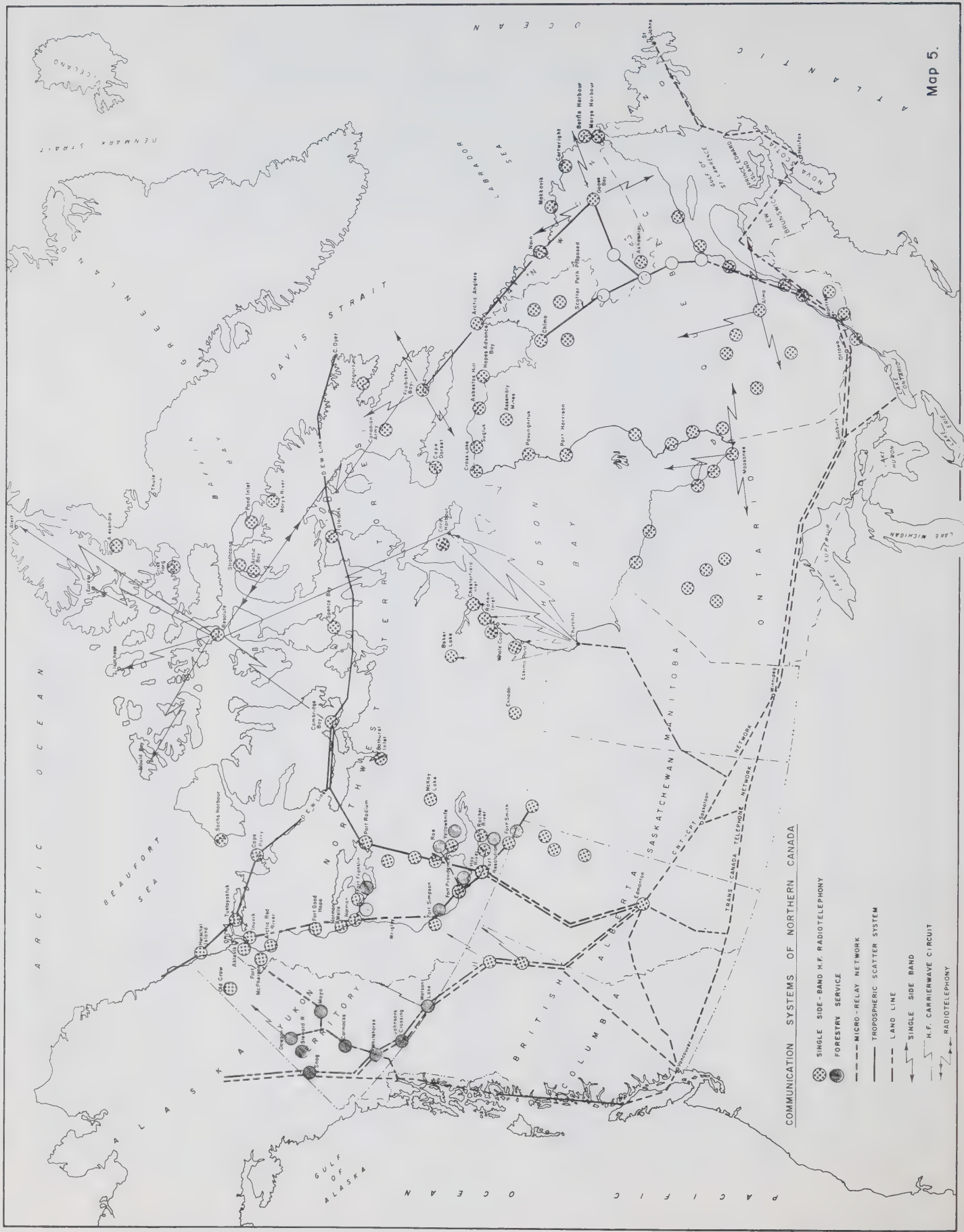


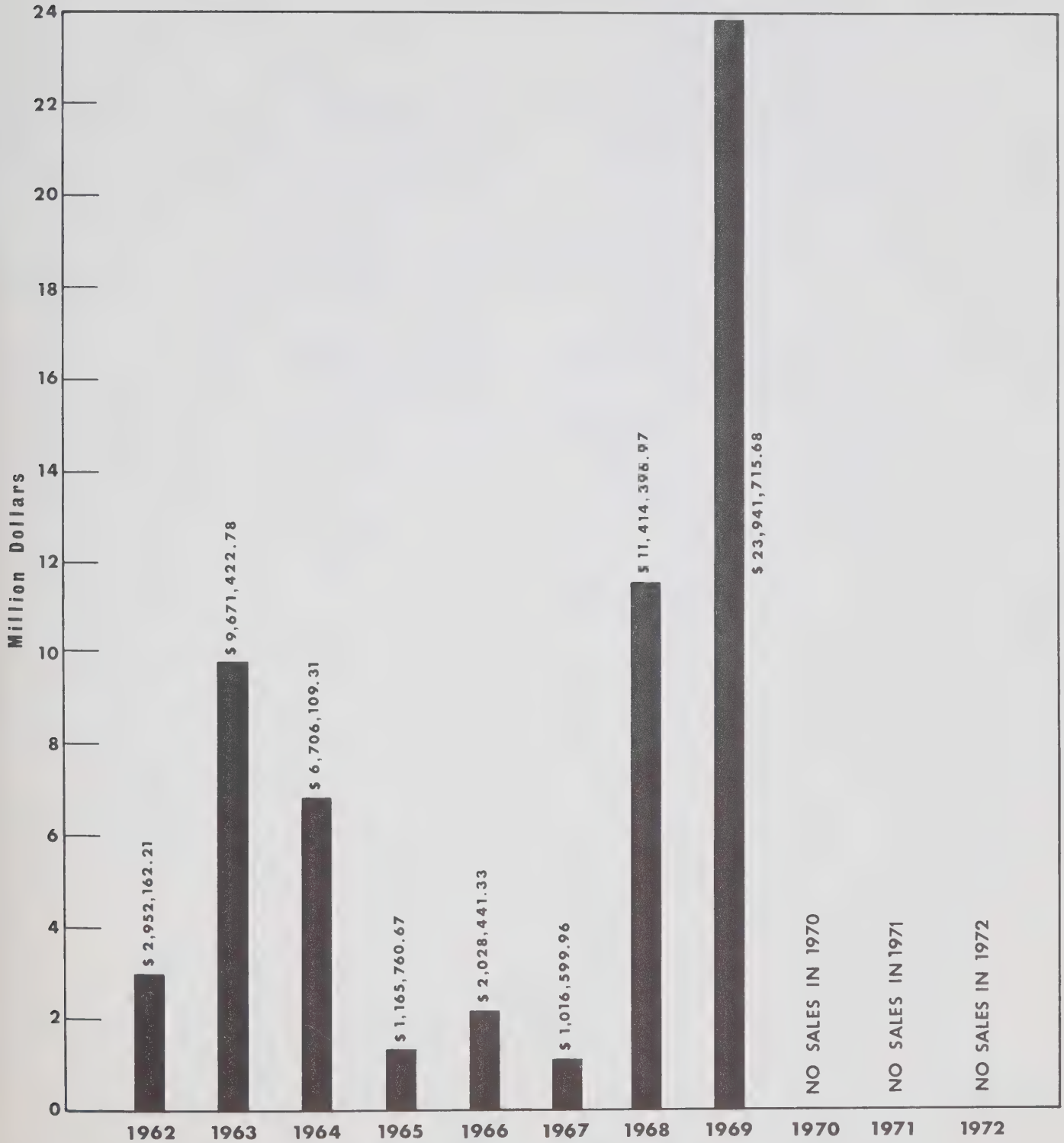
Fig. 13

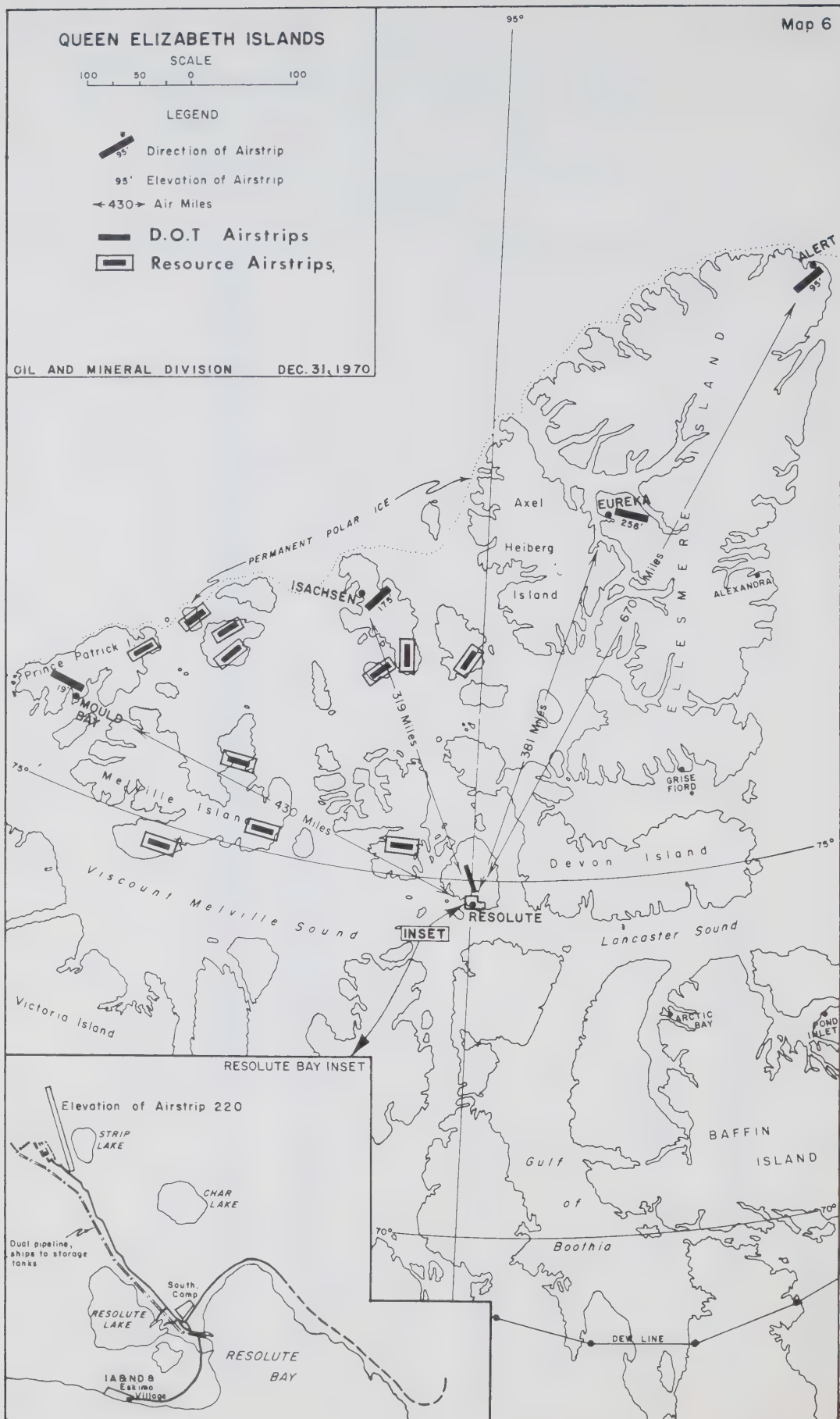
VALUE OF WORK BONUS TENDERS—OIL & GAS

YUKON TERRITORY AND NORTHWEST TERRITORIES

NOTE : Cumulative Value End of Dec.1969

\$58,896,608.91





Appendix I

Publications

A. Maps

Many maps dealing with the northern resource activities are published by the Division and are available from the Oil and Gas Land and Exploration Section, Calgary, Alberta, or from the Chief, Oil and Mineral Division, Ottawa. The Oil and Mineral Division publishes a list of maps which may be obtained from either of the above sources.

B. The following reports may be obtained from Information Canada or the Oil and Gas Land and Exploration Section, Calgary. Pre-payment is required.

Schedule of Wells 1920-1960	-- \$ 3.00 (out of print)
Schedule of Wells 1920-1961	-- 4.00 (out of print)
Schedule of Wells 1920-1963	-- 4.00 (out of print)
Schedule of Wells 1920-1964	-- 2.00 (out of print)
Schedule of Wells 1965	-- 3.00 (out of print)
Schedule of Wells 1966	-- 3.00 (out of print)
Schedule of Wells 1967	-- 2.50
Schedule of Wells 1968	-- 2.50
Schedule of Wells 1969	-- 2.50
Schedule of Wells 1970	-- 2.50
Schedule of Wells 1921-1971	-- 10.00
Schedule of Wells 1972	-- 3.00 (in press)
Oil and Gas Statistical Report No. 1 (1920-1960)	-- 2.50 (out of print)
Oil and Gas Statistical Report No. 2 (1961-1970)	-- in preparation

"Technical Reports available for Inspection 1973." (Geological and Geophysical Reports released from confidential status are available for public inspection only in the office of the Oil and Gas Land and Exploration Section of this Department in Calgary).

-- No charge

Other Sources of Information

Information on northern resource activities can be obtained from the Chief, Oil and Mineral Division, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa. All cores and samples from wells drilled on Canada lands north of 60°N. latitude are stored at the Institute of Sedimentary and Petroleum Geology, 3303-33rd. St. N.W., Calgary, Alberta. Specialized and technical literature

pertaining to Northern Canada can be purchased or perused at the following government agencies:

- (a) Northern Co-ordination Division Library, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa, Ontario.
 - (1) Oil and Gas Land and Exploration Section, Department of Indian Affairs and Northern Development, Calgary.
- (b) Department of Energy, Mines and Resources.
 - (1) Geological Survey of Canada -- Ottawa and Vancouver, B.C.;
 - (2) Institute of Sedimentary and Petroleum Geology -- Calgary, Alberta.
 - (3) Atlantic Geoscience Centre, Bedford Institute of Oceanography -- Dartmouth, Nova Scotia.
- (c) Defence Research Board, Scientific Information Service -- Ottawa.
- (d) Ministry of Transport
 - (1) Marine Works Branch -- Ottawa, Ontario.
 - (2) Marine Operations Branch -- Ottawa, Ontario.
 - (3) Telecommunications and Electronics Branch -- Edmonton, Alberta and Ottawa, Ontario.
 - (4) Civil Aviation Branch -- Winnipeg, Manitoba
- (e) Arctic Institute of North America -- Montreal, Quebec.
- (f) National Research Council -- Ottawa, Ontario.
 - (1) Dominion Observatories Branch -- Ottawa, Ontario.
- (g) The following brochures published by this Department may be available in some Public Libraries:
 - i Guide to Northern Non-Renewable Resources
 - ii Communication and Transportation Facilities Queen Elizabeth Group -- Arctic Islands
 - iii Resource Management Division -- Responsibilities and Administration
 - iv Oil and Gas Canada Lands -- Volume No. 2
 - v Oil and Gas Canada Lands -- Edition No. 3
 - vi Oil and Gas in the Yukon and Northwest Territories -- Edition No. 4 - 1967
 - vii Oil and Gas -- North of 60 - 1968
 - viii Oil and Gas -- North of 60 - 1969
 - ix Oil and Gas -- North of 60 - 1970
 - x Oil and Gas -- North of 60 - 1971
 - xi Prospectus -- North of 60

Information and Procedures Concerning Operations on Canada Lands

Certain federal agencies are concerned with exploration on Canada lands and must be notified prior to the commencement of any exploration activity. The operator or permittee, not the contractor, is responsible for providing the requisite

advance notice of planned programs to these agencies by writing directly to them.

For offshore programs the Regional Director of Resources at Yellowknife, Northwest Territories, in addition to the Oil and Mineral Division, must be informed with respect to each program. He will communicate with every department and agency on the need-to-know basis with respect to Marine Geophysical Programs. In the case of the Hudson Bay region, operators must also inform the National Research Council of proposed operations when undertaken during the summer months. Circumstances may be such that other agencies should be notified as well, and these are listed on the following pages, together with the names of persons who can be of assistance. For example, since operators are responsible for any damage they may cause to underwater commercial cables, it is recommended that they contact the Canadian Hydrographic Service for cable-lay data covering the area over which the work is to be performed. Similarly, the Customs Excise Department should be contacted by the importing company if vessels or equipment are to be brought in from abroad.

Department of Indian Affairs and Northern Development

1. Pursuant to Section 52 of the Canada Oil and Gas Land Regulations, "Notice of Commencement of Exploratory Work" must be filed 15 days prior to commencement of proposed exploratory programs (geophysical, geological and research) on the mainland in the Northwest Territories and Yukon Territory and Arctic Islands, and 45 days prior to commencement of geophysical work on offshore areas with the,

Oil and Gas Land and Exploration Section
Oil and Mineral Division,
Department of Indian Affairs and Northern Development,
112 - 11th Avenue S.E.,
Calgary, Alberta T2G 0X5
Phone: 403-264-0201

2. Information and assistance may be obtained from:
Chief

Oil and Mineral Division,
Northern Natural Resources and Environment Branch,
Department of Indian Affairs and Northern Development,
400 Laurier Avenue West,
Ottawa, Ontario.
Name: Dr. H.W. Woodward,
Phone: 613-992-0223

3. Advice on exploratory programs and operational matters may be obtained from:
Operations Supervisor,
Oil and Mineral Division,
Northern Natural Resources and Environment Branch,
Department of Indian Affairs and Northern Development,
Ottawa, Ontario.
Name: S.A. Kanik
Phone: 613-992-0921

4. Drilling Authority and advice on drilling matters can be obtained from the District Conservation Engineer for the District. See Map No. 7 for description of District outlines.

Oil and Gas Drilling and Conservation Section

Chief Petroleum Engineer	— Dr. H.J. Berry
Assistant Chief Petroleum Engineer, Drilling and Conservation	— M.K. El-Defrawy
Assistant Chief Petroleum Engineer, Offshore	— S.V. Benediktson
Assistant Chief Petroleum Engineer, Reservoir	—
Assistant Chief Petroleum Engineer, Production Systems	— R.L. Price
Chief Petroleum Engineer	— M.D. Thomas in Yellowknife
District Oil and Gas Conservation Engineers	— A.J. McCaskill for Arctic Islands in Calgary, District 1
	— A.F. Halcrow for N.E. & N.W. Sectors in Inuvik, District 2 and 3
	— G.E. Blue for S.W. Sector in Yellowknife, District 4
	— for S.E. Sector in Yellowknife, District 5

5. A Land Use Permit must be acquired for every land use operation, this includes drilling operations. Information and advice on the Land Use Regulations and Land Use Permits can be obtained

for the Northwest Territories:

Regional Director of Resources,
P.O. Box 1500
Yellowknife, N.T.W.
Name: G.B. Armstrong
Phone: 403-873-4421

for the Yukon Territory:

Regional Director of Resources, Room 211, Federal Building, Whitehorse, Y.T. Name: B.J. Trevor Phone: 403-667-7861

Department of Energy, Mines and Resources

(A) *Resource Management and Conservation Branch*

The Resource Management and Conservation Branch is responsible for the administration of federal interest in the

mineral resources off Canada's east and west seacoasts and in the Hudson Bay and Hudson Strait regions.

All correspondence should be addressed to:
Director,
Resource Management and Conservation Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Name: D.G. Crosby
Phone: 613-994-5065

(B) *Surveys and Mapping Branch*

Information on the systems, methods and equipment utilized in positioning and surveying with respect to exploration work may be subject to review by this agency. Moreover, legal surveys must be made in accordance with instructions of the Surveyor General.

Inquiries concerning surveying may be directed to:
Surveyor General,
Legal Surveys Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Name: R. Slessor
Phone: 613-994-9174

Information concerning coastal control surveys may be obtained from:
Geodetic Survey Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Attention: C.E. Hoganson
Phone: 613-994-5079

When requesting control survey data, the enquiries should define the area involved by latitude and longitude. In the case of a large area, it is important to state priorities within the area to facilitate processing.

Air photographs covering all portions of Canada may be obtained from:
National Air Photo Library,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Attention: G.H. Whitcher
Phone: 613-994-5433

and

Publications and Air Photo Section,
Institute of Sedimentary and Petroleum Geology,
3303-33rd St. N.W.,
Calgary, Alberta.
T2L 2A7
Attention: Mrs. M.H. Brooks
Phone: 403-284-0110

Topographic maps, indices charts, atlases and numerous other map publications may be obtained from:

Map Distribution Office,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Attention: G.A. Clemmer
Phone: 613-994-9663

and

Publications and Air Photo Service,
Institute of Sedimentary and Petroleum Geology,
3303-33rd St. N.W.,
Calgary, Alberta.
T2L 2A7
Attention: Mrs. M.H. Brooks
Phone: 403-284-0110

(C) *Geological Survey of Canada*

The Geological Survey of Canada carries out systematic geological and geophysical surveys in the sedimentary basins of Canada, including parts of the regions offshore from the east and west coasts, in Hudson Bay, and in the Arctic Islands.

Inquiries with regard to the operations and publications of the Geological Survey should be made to:
Director,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Name: D.J. McLaren
Phone: 613-994-5817

or to:

Director,
Institute of Sedimentary and Petroleum Geology,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Calgary, Alberta.
Name: D.F. Stott
Phone: 403-284-0110

(D) *Polar Continental Shelf Project*

The Polar Continental Shelf Project is a continuous investigation of the continental shelf fringing the Arctic coast of Canada, together with adjacent parts of the Arctic Ocean basin, the islands of the Canadian Arctic Archipelago and the waters between them, and other areas of special interest.

Inquiries regarding surveys and scientific studies in Arctic areas may be directed to:
Co-ordinator,
Polar Continental Shelf Project,
Department of Energy, Mines and Resources,
Ottawa, Ontario
Name: G. Hobson,
Phone: 613-996-3388

Department of the Environment

(A) *Resource Development Branch*

Advance notice of 90 days is required before the start of a marine seismic survey involving the use of high explosives, in the event that qualified observers are needed. Nominal advance notice of 15 days to the Regional Director is required before the start of a seismic survey in which a source of accoustical energy other than high explosives is to be used.

Written notices should be sent to the appropriate Regional Director of Fisheries with a copy to:

Assistant Deputy Minister,
Environmental Protection Service,
Department of the Environment,
Fontaine Building,
Hull, Quebec.

Name: K.C. Lucas

Phone: 613-997-8041

Information regarding the Department's requirement can also be obtained from:

A/Director,
Resource Development Branch.

Name: E.W. Burrige

Phone: 613-996-0701

The Address of the Regional Director responsible for all fresh water lakes in the Northwest Territories is:

C. McEwan,
114 Gary Street,
Winnipeg 1, Manitoba.
Phone: 204-946-8101

In the Yukon Territory is:

W.R. Hourston,
1155 Robson Street,
Vancouver 5, B.C.
Phone: 604-666-1671

Information concerning wildlife such as the locations of migratory bird sanctuaries and National Wildlife Areas may be obtained from:

Director,
Canadian Wildlife Service,
Department of the Environment,
400 Laurier Avenue West,
Ottawa, Ontario.
Attention: N.G. Perret
Phone: 613-992-5305

(B) *Atmospherical Environment Service*

Requests for information and assistance on meteorological and sea-ice data, climatology, weather forecasting, meteorological instruments and research may be directed to:

Assistant Deputy Minister,
Atmospheric Environment Service,
Department of the Environment,
4905 Dufferin Street,
Toronto, Ontario.

Name: J.R.H. Noble

Phone: 416-667-4774

Information may also be obtained through the Meteorological Liaison Officer in Ottawa. This position is filled on a rotation basis and the name of the officer is subject to change. Inquiries in Ottawa may be directed to:

Liaison Meteorologist,
Department of the Environment,
Fontaine Building,
Hull, Quebec.

Name: D.J. Wright

Phone: 613-996-0807

Information concerning ice may be obtained from:

Superintendent,
Ice Forecasting Central,
Department of the Environment,
Trebla Building,
Ottawa, Ontario. KIA OH3

Name: W.E. Markham

Phone: 613-996-5236

(C) *Marine Sciences Branch*

In addition to providing the commercial-cable lay data, the Canadian Hydrographic Service publishes charts of Canadian coastal waters, and information concerning these may be obtained from:

Canadian Hydrographic Service,
Marine Sciences Branch.
Attention: W.J. Covey
Phone: 613-994-9155

Information concerning charts showing Canada's Territorial Sea and Fishing Zone Limits and related data may be obtained from:

Canadian Hydrographic Service,
Marine Sciences Branch.
Attention: E.J. Cooper
Phone: 613-994-5411

Information on physical oceanography may be obtained from:

Canadian Oceanographic Data Centre,
Marine Sciences Branch.
Attention: C.M. Cross
Phone: 613-992-3940

Information on tides may be obtained from:

Tides and Water Levels,
Marine Sciences Branch.
Attention: G.C. Dohler
Phone: 613-994-9122

Information on hydrographic surveys and control data in the western Arctic regions may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
512 Federal Building,
Victoria, B.C.
Name: M. Bolton
Phone: 604-338-3188

Information on hydrographic surveys and control data in the eastern Arctic may be obtained from:
Regional Hydrographer,
Canadian Hydrographic Service,
Atlantic Oceanography Laboratory,
Bedford Institute,
Dartmouth, N.S.
Name: R.C. Melanson
Phone: 902-426-3497

Department of National Defence

Maritime Commanders

The appropriate Office of Maritime Command will be advised on the need-to know basis by the Regional Director of Resources of any exploration program proposed for the offshore.

Operations in Baffin Bay and Arctic waters east of longitude 105° West are handled by the office of:
Commander Maritime Command,
Department of National Defence,
F.M.O. HMC Dockyard,
Halifax, Nova Scotia.

Operations in Arctic waters west of longitude 105° West are handled by the office of:
Maritime Commander (Pacific)
Department of National Defence,
F.M.O. HMC Dockyard,
Victoria, B.C.

Ministry of Transport

(A) Aids to Navigation Division

At least 60 days notice is required by this Division before the commencement of any offshore exploration program in order that appropriate local Notices to Shipping and national Notices to Mariners may be issued. These Notices are subsequently copied into related foreign publications.

The Division also indicates the requirement for any aids to navigational devices that may be necessary for the program.

Advance notice of 90 days is required in any case where drilling involves the territorial sea, in order for approval to be granted under the Navigable Waters Protection Act.

All Communications on these matters should be directed to:
Chief, Aids to Navigation,
Marine Works Branch,
Ministry of Transport,
Ottawa, Ontario.
Phone: 613-992-2736

In Addition, there are a number of Departmental officers who may be contacted in the field should the need arise. Their titles and addresses are given below:

District Marine Agent
Ministry of Transport,
P.O. Box 310, Uppertown,
Quebec 4, Quebec
(This office handles Hudson Bay)

District Manager,
Ministry of Transport,
P.O. Box 155
Hay River, N.W.T.
Phone: 403-874-2331

(B) Marine Operations Branch

This agency directs the operations of the Canadian Coast Guard which has major responsibilities in two areas of concern to offshore operations: support of shipping in ice-congested waters, and marine search and rescue.

If operations are being contemplated for areas where ice may be a problem and where ice-breaker or other support may be desired, there should be consultation with the Director of Marine Operations as long in advance as possible. This is particularly important in the case of Arctic and Hudson Bay operations where the planning of ice-breaker disposition is usually done six months in advance of the season.

Further information and assistance may be obtained from:
Director,
Marine Operations Branch,
Ministry of Transport,
Ottawa, Ontario.
Phone: 613-992-4209

(C) Marine Regulations Branch

This Branch includes the Steamship Inspection Division and the Nautical and Pilotage Division. The responsibilities of the former Division include inspection and certification of vessels under the Canada Shipping Act, oil pollution by vessels, and safety, pilotage, marine accident investigation and inquiries, salvage, marine personnel and navigational safety matters. This last includes the establishment of restricted navigation areas and the routing of ships.

Further information and assistance may be obtained from:
Director,
Marine Regulations Branch,
Ministry of Transport,
Ottawa, Ontario.
Name: R.R. Magillivray
Phone: 613-992-8892

Information with regard to safety of life at sea and acceptable standards of seaworthiness may be referred to:
Chairman,
Board of Steamship Inspection,
Marine Regulations Branch,
Name: Capt. G. Graves
Phones: 613-992-1312

(D) Pollution Contingency Office

This agency is responsible for the contingency planning function of the Ministry of Transport and also provides co-ordination and assistance when a federal response is made to combat a spill of oil or toxic materials into the marine environment. The response is made under the Interim Federal Contingency Plan or, in the case of international boundary waters, the appropriate Joint International Plan.

Clean-up equipment has been placed at strategic locations throughout the country to fulfill this responsibility. On-scene commanders are designed within the plans for each of the areas concerned.

Further information and assistance may be obtained from:
Pollution Contingency Office,
Ministry of Transport,
Tower "C", Place de Ville,
Ottawa, Ontario K1A 0N7.
Name: W.J.H. Stuart
Phone: 613-992-9743
or 613-992-9210

Department of Communications

The responsibilities of this agency include the development of technical standards, the selection and coordination of radio frequencies, and the licensing of all classes of radio station except broadcasting.

An operator contemplating the use of radio communications in his offshore activities should make application for licensing of any radio station in Canada or on board any Canadian vessel involved at least six weeks before the proposed in-service date of the communication facility. Details as to the licensing requirements and the necessary application forms may be obtained from the Regional Superintendent, Telecommunications Regulations Branch, Department of Communications:

Oil companies in Western Canada may contact:
Radio Superintendent,
Telecommunications Regulation Branch,
Department of Communications,
Federal Building,
Edmonton, Alberta.
Name: L.E. Nelson
Phone: 403-424-0251 (Extension 334)

If need be, the following persons in Ottawa may be contacted for assistance:

Director,
Telecommunications Regulation Branch,
Department of Communications,
Ottawa, Ontario.
Name: W.J. Wilson
Phone: 613-992-0840

Advice in determining communication requirements and the necessary applications for licence may also be obtained from:

Chief,
Licensing and Authorization Section
Department of Communications,
Ottawa, Ontario.
Name: A.G.E. Argue
Phone: 613-992-2830

National Research Council

Space Research Facilities Branch

Operators planning offshore activities in the Hudson Bay region must inform the following agency of the National

Research Council well in advance since rockets are fired on a year round basis from the Churchill River Range:

Head,
Range Section,
Space Research Facilities Branch,
National Research Council.
Ottawa, Ontario.
Name: Z.R. Charko
Phone: 613-993-9385

Operators active in the Hudson Bay region are also required to co-ordinate their field activities with:

General Superintendent,
Churchill Research Range,
National Research Council,
Fort Churchill, Manitoba.
Name: T.W. McGrath
Phone: 204-956-3010

Rockets are also launched from time to time from the facilities at Resolute Bay, N.W.T. and operators with exploration work planned for this vicinity are urged to co-ordinate their activities with the National Research Council.

Department of National Revenue

Customs and Excise

The Port Administration administers that portion of the Canada Shipping Act that relates to the coasting trade. In this connection, any company importing ships or specialized plant and equipment for exploration work on Canada's seacoasts may obtain information, assistance and such other contracts as may be necessary in Customs and Excise from:

Director,
Port Administration Division,
Customs and Excise,
Department of National Revenue,
Ottawa, Ontario.
Name: M.A. Gallup
Phone: 613-992-4952

Department of Manpower and Immigration

Canada Immigration Division

Inquiries should be directed to:
Department of Manpower and Immigration
Home Services Branch,
Canada Immigration Division,
Admissions Facilitation Section,
Ottawa, Ontario.
Attention: Mr. G.E. White
Phone: 613-992-7374

The Calgary and Edmonton offices of the Department of Manpower and Immigration can answer any queries regarding entry into the Northwest Territories. The Vancouver office can respond to queries for entry into the Yukon Territory.

At Tuktoyaktuk, a local R.C.M.P. officer is also a representative of the Department of Manpower and Immigration and can clear entry into Canada via Tuk.

At Inuvik, the Customs Department is also Departmental representative for Manpower and Immigration and can be

contacted by telephone if prior arrangements are necessary. There is no representative at Aklavik; in the event that a seismic crew prefers to land at Aklavik, arrangements must be made with the Inuvik representative.

Communications

Information in the brochure "Communications and Transportation Facilities, Queen Elizabeth Group, Arctic Islands", is being updated and will be available in a comprehensive report entitled "Operational Guide for Oil and Gas Companies in the North". This publication is now in preparation and should be available by June 1973. In addition to information concerning communication and transportation, the report will contain information covering all aspects of exploration in the North.

Appendix II

Oil and Gas Well Discoveries

Yukon Territory

Canada Southern et al N. Beaver R.
Y.T. I-27
I-27-60-10-124-00

Suspended gas well
September 29, 1964

Canoe River Chance Y.T. J-19
J-19-66-10-124-15

Suspended gas well
February 17, 1968

Pan Am Beaver River Y.T. G-01
G-01-60-10-124-15

Gas well
August 20, 1969

Socony Mobil et al Chance Y.T. G-08
G-08-66-10-137-30

Suspended oil well
March 31, 1965

Socony Mobil et al Blackie No. 1
Y.T. M-59
M-59-66-00-137-00

Suspended gas well
March 27, 1964

Socony Mobil et al Birch, Y.T. B-34
B-34-66-10-136-45

Suspended gas well
June 8, 1965

Western Minerals Chance Y.T. No. 1
M-08
M-08-66-10-137-30

Suspended oil and gas
well January 31, 1960

Northwest Territories

Briggs Rabbit Lake No. 3 B-07
B-07-61-00-118-45

Suspended gas well
March 9, 1957

Briggs Rabbit Lake No. 1 O-16
O-16-61-00-118-45

Suspended gas well
March 17, 1955

CPOG et al LaBiche F-08
F-08-60-40-124-30

Suspended gas well
March 19, 1971

Gulf Mobil Parsons F-09
F-09-69-00-133-30

Suspended gas well
April 19, 1972

Gulf Imp. Shell Titalik K-26
K-26-69-10-135-00

Abandoned gas well
February 20, 1973

Gulf Imp. Shell Reindeer F-36
F-36-69-10-134-30

Suspended gas well
June 5, 1973

Gulf Mobil Ya Ya P-53
P-53-69-20-134-30

Suspended gas well
March 16, 1973

HB Cameron Hills A-05
A-05-60-10-117-30

Suspended gas well
April 16, 1968

HB Amoco S. Island River M-52
M-52-60-10-121-00

Suspended gas well
February 23, 1973

HB Pan Am S. Island R. M-41
M-41-60-10-121-00

Suspended gas well
March 23, 1964

Home Signal Celibeta H-78
H-78-60-10-122-00

Suspended gas well
March 13, 1960

IOE Atkinson H-25
H-25-69-50-131-45

Suspended oil well
February 23, 1970

Imp. Ivik J-26
J-26-69-40-134-15

Suspended gas well
September 30, 1972

Imp. IOE Mallik L-38
L-38-69-30-134-30

Abandoned gas well
April 4, 1972

IOE Mayogiak J-17
J-17-69-30-132-45

Suspended oil well
August 6, 1971

IOE Taglu G-33
G-33-69-30-134-45

Suspended gas well
August 18, 1971

Imp. IOE Taglu West P-03
P-03-69-30-135-00

Suspended gas well
March 29, 1972

IOE Taglu C-42
C-42-69-30-134-45

Suspended gas well
November 18, 1972

Pacific Amoco Tathlina N-18
N-18-60-20-118-00

Suspended gas well
February 19, 1973

Pan Am Pointed Mountain O-46
O-46-60-30-123-45

Producing gas well
October 2, 1971

Pan Am Pointed Mountain P-53
P-53-60-30-123-45

Producing gas well
March 10, 1967

Pan Am Pointed Mountain K-45
K-45-60-30-123-45

Producing gas well
May 8, 1968

Pan Am Pointed Mountain G-62
G-62-60-30-123-45

Shut-in gas well
June 20, 1969

Shell HB Grumbler G-63
G-63-60-20-115-45

Abandoned gas well
March 16, 1969

Shell Niglintgak H-30
H-30-69-20-135-15

Suspended gas well
April 7, 1973

Sun Netla C-07 C-07-60-50-122-45	Suspended gas well April 5, 1961
Texaco Bovie Lake J-72 J-72-60-20-122-45	Suspended gas well April 20, 1966
Union Pan Am Trainor Lake C-39 C-39-60-20-120-30	Suspended gas well March 15, 1965
<i>Arctic Islands</i>	
Dome Arctic Ventures Wallis K-62 K-62-78-00-102-00	Suspended gas well February 21, 1973
Panarctic Drake Point L-67 L-67-76-30-108-30	Suspended gas well February 26, 1970
Panarctic King Christian D-18-A D-18-77-50-101-00	Suspended gas well March 15, 1971
Panarctic Tenneco King Christian N-06 N-06-77-50-101-00	Suspended gas well October 8, 1971
Panarctic Tenneco et al Kristoffer Bay B-06 B-06-78-20-102-30	Suspended gas well March 17, 1972
Panarctic Tenneco et al Thor P-38 P-38-78-10-103-00	Suspended oil well May 10, 1972
Panarctic et al Drake F-16 F-16-76-30-108-30	Suspended gas well June 16, 1972
Panarctic et al Drake B-44 B-44-76-30-108-00	Suspended gas well October 22, 1972
Panarctic et al Hecla F-62 F-62-76-30-110-00	Suspended gas well December 12, 1972
Panarctic et al Hecla I-69 I-69-76-20-110-00	Suspended gas well April 11, 1973
Panarctic Romulus C-42 C-42-80-00-84-00	Abandoned oil well July 25, 1972

Appendix III

Wells Abandoned or Completed in 1972

Northwest Territories — Arctic Islands

Name of Well	Spudded	Completed	Status	Total Depth
BP et al Graham C-52	21-02-72	16-05-72	Suspended	10,110
BP et al Satellite F-68	17-09-71	02-05-72	D & A	12,075
Elf Nanuk D-76	17-01-72	04-03-72	D & A	4,518
Elf Uminmak H-07	01-04-72	07-05-72	D & A	5,573
Imp. IOE et al Devon E-45	16-12-71	05-03-72	D & A	6,030
Imp. Panarctic Dome et al Hoodoo L-41	06-05-72	24-07-72	D & A	14,040
Panarctic et al Brock C-50	12-11-71	22-03-72	D & A	12,996
Panarctic Brock I-20	14-04-72	28-06-72	D & A	10,422
Panarctic et al Dome Bay P-36	23-05-72	18-07-72	D & A	8,050
Panarctic et al Drake F-16	10-05-72	15-06-72	Suspended gas well	4,850
Panarctic et al Drake B-44	23-09-72	22-10-72	Suspended gas well	4,580
Panarctic Gulf Dumbbells E-49	10-01-72	18-05-72	D & A	11,182
Panarctic et al Hecla F-62	11-11-72	11-12-72	Suspended gas well	4,000
Panarctic Helicopter J-12	03-06-72	18-11-72	D & A	12,512
Panarctic et al Kristoffer Bay B-06	09-11-71	17-03-72	Suspended gas well	12,877
Panarctic Noice G-44	29-09-72	29-10-72	D & A	5,791
Panarctic Romulus C-42	29-01-72	25-07-72	D & A	14,940

Panarctic et al Thor P-38	06-04-72	10-05-72	Suspended oil well	6,000
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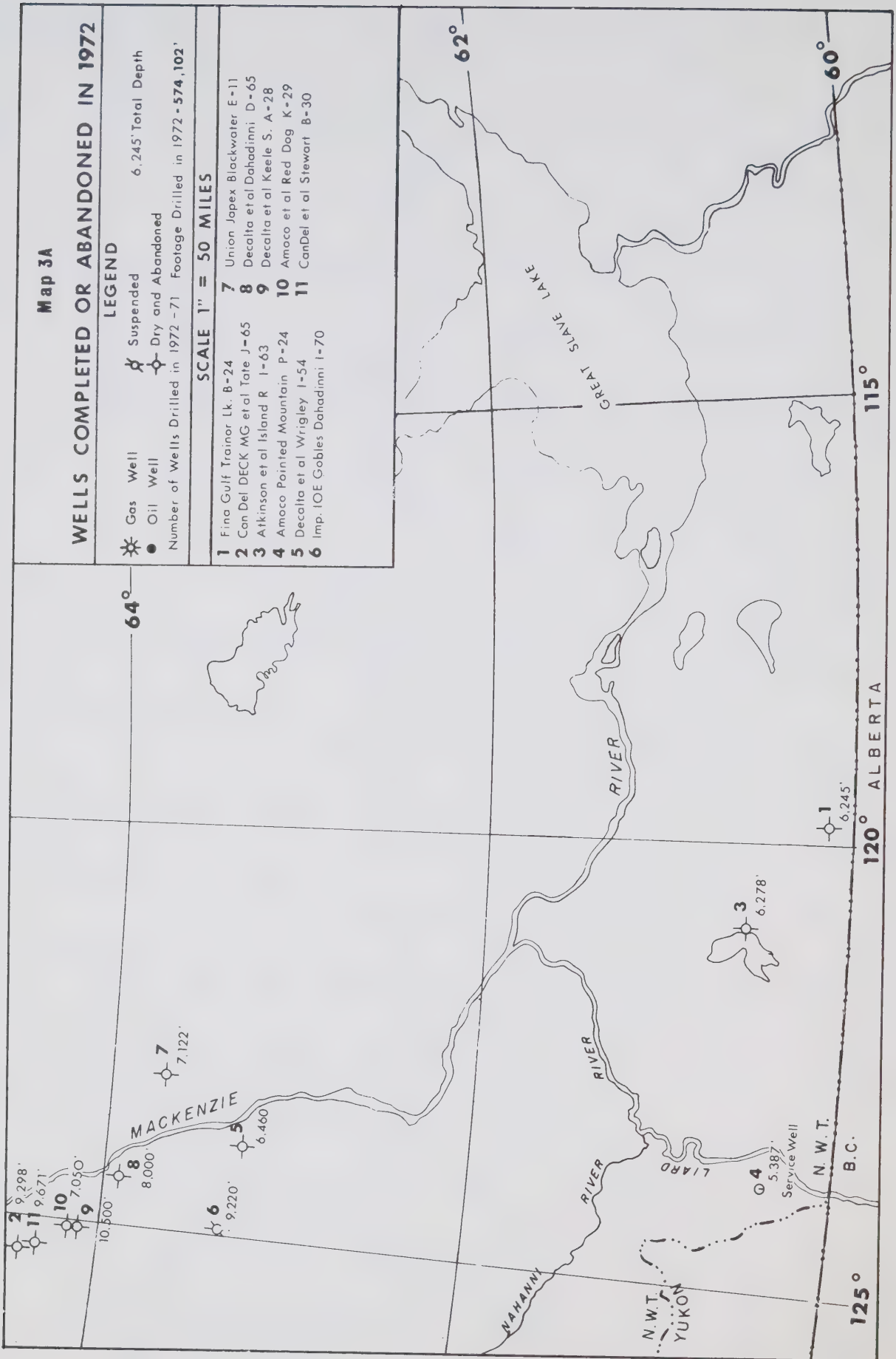
Panarctic Gulf West Amund I-44	30-03-72	21-04-72	D & A	3,137
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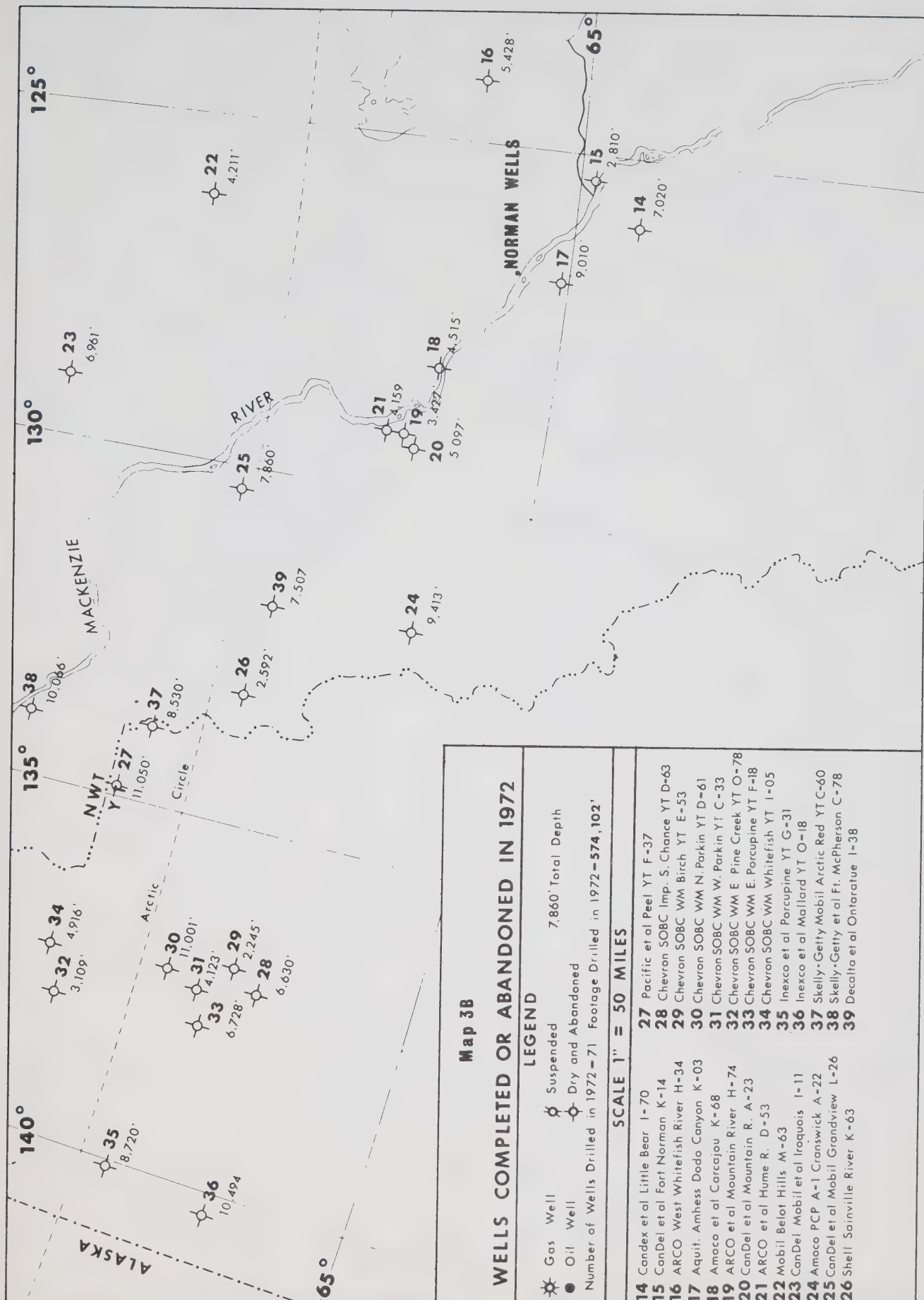
Sun Panarctic Russell E-82	07-12-71	27-01-72	D & A	6,020
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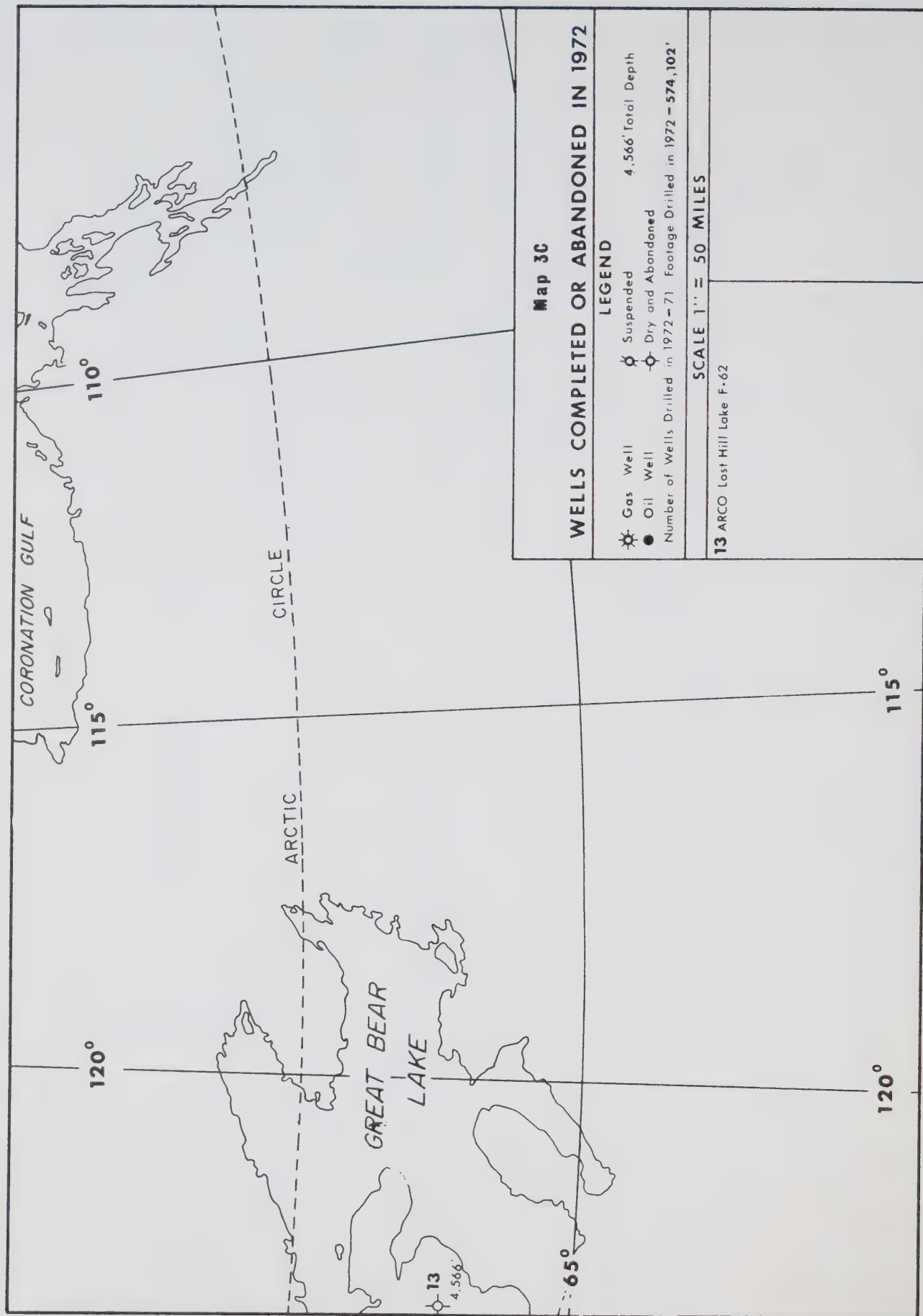
Northwest Territories — Mainland

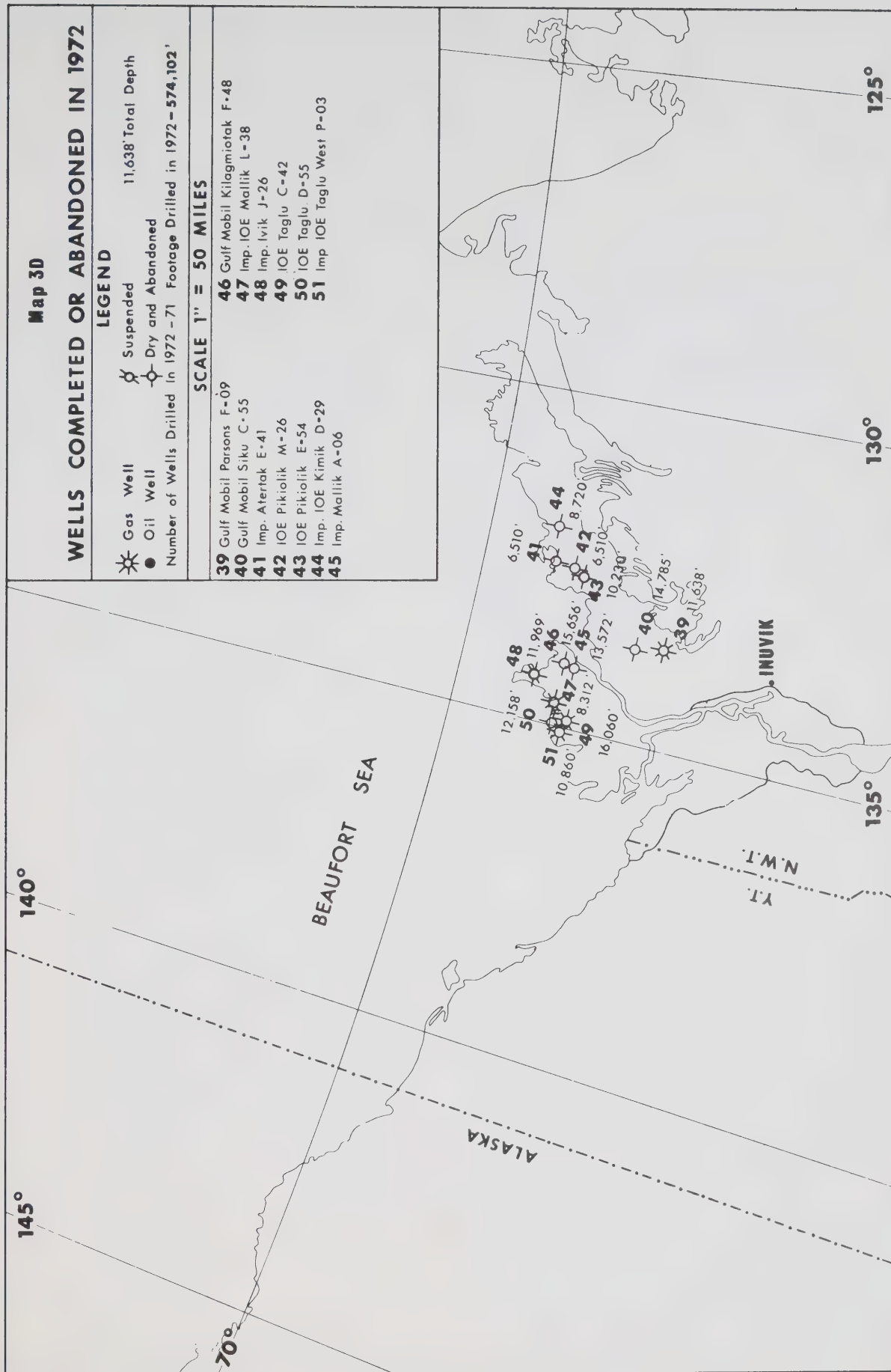
Name of Well	Spudded	Completed	Status	Total Depth
Amoco et al Carcajou K-68	09-02-72	17-03-72	D & A	4,515
Amoco PCP A-1 Cranswick A-22	25-01-72	28-03-72	D & A	9,413
Amoco Pointed Mountain P-24	11-02-72	09-04-72	Service well	5,387
Amoco et al Red Dog K-29	11-01-72	28-03-72	D & A	7,050
ARCO et al Hume River D-53	20-01-72	11-02-72	D & A Well turned over to EMR as a Temp. Observation Well	4,159
ARCO Lost Hill Lake F-62	02-02-72	07-03-72	D & A	4,566
ARCO et al Mountain River H-47	03-12-71	13-01-72	D & A	3,427
ARCO West Whitefish River H-34	14-03-72	13-04-72	D & A	5,428
Aquit. Amhess Dodo Canyon K-03	28-11-71	20-01-72	D & A	9,010
Atkinson et al Island R. I-63	21-02-72	21-03-72	D & A	6,278
CanDel et al Mobil Grandview L-26	09-03-72	11-05-72	D & A	7,860
CanDel et al Fort Norman K-14	16-04-72	27-04-72	D & A	2,810

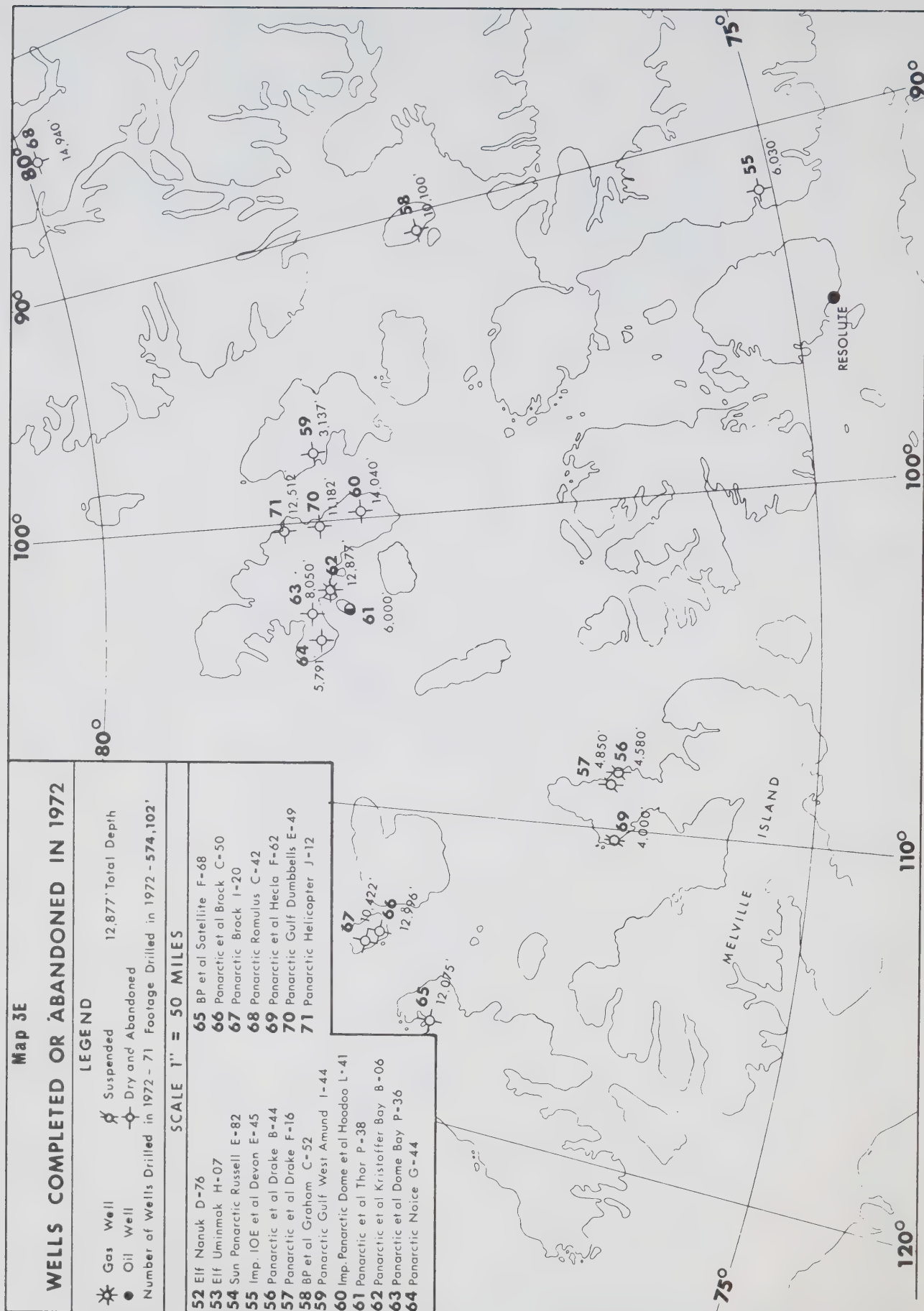
CanDel Mobil et al Iroquois I-11	20-04-72	03-06-72	D & A	6,961	Imp. IOE Taglu West P-03	12-12-71	29-03-72	Gas well	10,860
CanDel et al Mountain R. A-23	25-03-72	26-04-72	D & A	5,097	IOE Taglu D-55	06-04-72	21-08-72	D & A	12,158
					IOE Taglu C-42	30-04-72	18-11-72	Gas well	16,060
CanDel et al Stewart B-30	15-02-72	09-04-72	D & A	9,671	Mobil Belot Hills M-63	31-01-72	08-04-72	D & A	4,211
CanDel DECK MG et al Tate J-65	30-11-71	08-02-72	D & A	9,298	Shell Sainville River K-63	12-01-72	23-01-72	D & A	2,592
Candex et al Little Bear I-70	25-04-72	15-05-72	D & A	7,020	Skelly Getty et al Ft. McPherson C-78	09-04-72	17-07-72	D & A	10,066
Decalta et al Keele S. A-28	15-02-72	20-05-72	D & A	10,500	Union Japex Blackwater E-11 Yukon Territory	22-02-72	04-04-72	D & A	7,122
Decalta et al Dahadinni D-65	27-11-71	24-01-72	D & A	8,000	Chevron SOBC WM Birch YT E-53	20-01-72	21-02-72	D & A	2,245
Decalta et al Ontaratue I-38	09-09-72	06-11-72	D & A	7,507	Chevron SOBC Imp. S. Chance YT D-63	21-01-72	01-05-72	D & A	6,630
Decalta et al Wrigley I-54	05-12-71	05-02-72	D & A	6,460					
Fina Gulf Trainor Lake B-24	19-02-72	25-03-72	D & A	6,245	<i>Yukon Territory</i>				
					Name of Well	Spudded	Completed	Status	Total Depth
Gulf Mobil Kilagmiotak F-48	04-02-72	12-10-72	D & A Temp. Observation Well	15,656	Chevron SOBC WM N. Parkin YT D-61	04-01-72	06-05-72	D & A	11,001
Gulf Mobil Parsons F-09	20-12-71	19-04-72	Gas well	11,638	Chevron SOBC WM N. Parkin YT C-33	29-11-71	15-01-72	D & A	4,123
Gulf Mobil Siku C-55	02-05-72	08-11-72	D & A	14,785	Chevron SOBC WM E. Pine Creek YT 0-78	25-12-71	26-01-72	D & A	3,109
Imp. Atertak E-41	01-05-72	13-07-72	D & A	6,510	Chevron SOBC WM E. Porcupine YT F-18	06-03-72	01-05-72	D & A	6,728
Imp. IOE Gobles Dahadinni I-70	13-01-72	30-03-72	D & A	9,220	Chevron SOBC WM Whitefish YT I-05	23-02-72	30-03-72	D & A	4,916
Imp. Ivik J-26	08-04-72	30-09-72	Susp. Temp. Obs. well	11,969	Inexco et al Mallard YT 0-18	02-05-72	19-08-72	D & A	10,494
Imp. IOE Kimik D-29	17-12-71	16-02-72	D & A	8,720	Inexco et al Porcupine YT G-31	31-12-71	24-03-72	D & A	8,720
Imp. IOE Mallik L-38	24-12-71	05-04-72	D & A	8,312	Pacific et al Peel YT F-37	13-02-72	20-03-72	D & A	11,050
Imp. Mallik A-06	21-04-72	08-10-72	D & A Temp. Observation Well	13,572	Skelly-Getty Arctic Red YT C-60	15-01-72	26-03-72	D & A	8,530
IOE Pikiolik M-26	22-12-71	07-12-72	D & A	6,510	NUMBER OF WELLS DRILLED IN 1972 – 71 TOTAL FOOTAGE DRILLED IN 1972 – 574,102				
IOE Pikiolik E-54	11-12-71	15-02-72	Casing Observation Well	10,230					











Appendix IV

The Oil and Mineral Division is a member of the "Federal-Provincial Committee on Energy Statistics" and the "Mines Ministers Subcommittee on Oil and Gas Statistics" and together with the four western provinces and Statistics Canada has standardized all its oil and gas reporting forms. This standardization has removed duplication between government agencies and more important, industry can now process all oil and gas reporting forms from the western provinces and the Yukon and Northwest Territories on computer machines without change of programs.

Form No.	Title of Form
IAN*52-90-1**	Application for a Drilling Authority
IAN*52-90-2	Well Completion Data
IAN*52-90-3**	Application to Amend a Drilling Authority
IAN*52-90-4**	Application to Change a Well Name
IAN*52-90-5**	Application to Abandon a Well or Suspend Drilling
IAN*52-90-6**	Application to Alter Condition of a Well
IAN*52-90-7	Work-over Report No.
IAN*52-90-8	Application to Commingle Production before Measurement
IAN*52-90-9	Data for Back Pressure Test on Natural Gas Wells — Monograph 7 Method
IAN*52-90-10	Data for Back Pressure Test on Natural Gas Wells Vitter's Method
IAN*52-90-11	M.P.R. — Oil Calculations
IAN*52-90-12	New Oil Well Report
IAN*52-90-13	New Gas Well Report
IAN*52-90-17	New Service Well Report
IAN*52-90-18	Monthly Water Flood Operations Report
IAN*52-90-20	Monthly Water Receipts and Disposal of Fluid Report
IAN*52-90-23	Geologic Surface Survey & Airphoto Analysis — Expenditures
IAN*52-90-24	Land Geophysical Operations — Expenditures
IAN*52-90-25	Marine Geophysical Programs — Expenditures
IAN*52-90-26	Drilling & Structure Test Drilling Expenditures
IAN*52-90-27	Participation Programs — Expenditures
IAN*52-91**	Notice of Commencement of Exploratory Work
IAN*52-92	Application for Authority to Drill Structure Test Hole
IAN*52-93	Report on Abandonment of Structure Test Hole
IAN*52-83	Grouping Notice
IAN*52-103**	Application for Oil and Gas Lease
IAN*51-183	Monthly Accident Summary

*To be completed by Operator.
**To be completed in triplicate; all other forms to be completed in duplicate.

All forms, except IAND 52-83, IAND 52-90-23 to IAND 52-90-27, IAND 52-91 and 52-103, are submitted to the appropriate District Oil and Gas Conservation Engineer.

Forms IAND 52-83, 52-90-23 to 52-90-27 and 52-103 are submitted to the Oil and Mineral Division, 400 Laurier Avenue West, Ottawa, Ontario K1A 0H4.

Form IAND 52-91 should be submitted to the Oil and Gas Land and Exploration Section, 112 - 11th Avenue S.E., Calgary, Alberta, T2G 0X5.

The following forms have been issued pursuant to the "Canada Oil and Gas Land Regulations" and the "Canada Oil and Gas Drilling and Production Regulations". These forms are to be completed when applicable during the production stage of oil and gas wells, and refinery operations.

Form No.	Title of Form
IAN*52-116-1	Monthly Production Report
IAN*52-116-2	Monthly Disposition and Crown Royalty Statement
IAN*52-116-3	Monthly Gas Gathering Statement
DBS 6511-38*	Monthly Oil Pipeline Gathering Operations Statement
IAN*52-116-5	Monthly Crude Oil and Condensate Purchaser's Statement
IAN*52-116-6	Monthly Gas Plant Statement
DBS 6511-37*	Monthly Natural Gas Distributors Statement
IAN*52-116-8	Monthly Gas Processing Plant Products Statement
IAN*52-116-9	Monthly Liquefied Petroleum Gas Purchaser's Statement
IAN*52-116-10	Monthly Refinery Operations Report
IAN*52-116-11	Monthly Gas Injection Operations Report
IAN*52-116-12	Statement of Nomination and Estimated Requirement for Crude Oil, Condensate and Pentanes Plus

Note: (a) All forms to be completed by the Operator.
(b) Forms 6511-37 and 6511-38 are completed by the Operator in triplicate. He forwards the first two copies to the Oil and Mineral Division in Ottawa, and the third to the District Oil and Gas Conservation Engineer responsible for the District in which the well is located (see Map 3). The other forms listed above are completed in duplicate. The original is submitted to the Oil and Mineral Division in Ottawa and one copy to the appropriate District Oil and Gas Conservation Engineer.

Appendix V

Selected geological references applicable to geological provinces and basins in Northern Canada are listed below.

For a complete list of oil industry technical reports released from confidential status, the reader should refer to the Departmental publication "Technical Reports Available for Inspection — 1973."

Northwest Territories

Geol. Surv. Can., Memoir 322	Stratigraphy of Middle Devonian and Older Palaeozoic Rocks of the Great Slave Lake Region Northwest Territories. A.W. Norris	Geol. Surv. Can., Paper 58-11	Great Slaves and Trout River Map Areas, Northwest Territories (Report and Maps 27-1958 and 28-1958) R.J.W. Douglas
Geol. Surv. Can., Memoir 374	Port Radium Map Area, District of Mackenzie G. Mursky	Geol. Surv. Can., Paper 61-1	Summary Account of Carboniferous and Permian Formations, Southwestern District of Mackenzie P. Harker
Geol. Surv. Can., Bulletin 95	Carboniferous and Permian Rocks, Southwestern District of Mackenzie P. Harker	Geol. Surv. Can., Paper 61-9	Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains, between the Headwaters of Blow and Bell River J.A. Jeletsky
Geol. Surv. Can., Bulletin 163 pp. 31-38	"Middle Cambrian Plagiura-Poliella Fanule from Southwest District of Mackenzie" B.S. Norford	Geol. Surv. Can., Paper 65-32	Geophysical Reconnaissance of Hudson Bay Peter Hood
Geol. Surv. Can., Bulletin 170	Middle Triassic (Anisian) ammonoids from northeastern British Columbia and Ellesmere Is. F.H. McLearn	Geol. Surv. Can., Paper 66-50	Jurassic and Triassic Rocks of the Eastern Slope of Richardson Mountains Northwestern District of Mackenzie J.A. Jeletzky
Geol. Surv. Can., Bulletin 185	Barremian Textulariina, Foreminiferida from Lower Cretaceous beds, Mount Goodenough section, Aklavik Range, District of Mackenzie T.P. Chamney	Geol. Surv. Can., Paper 67-8	Preliminary account of the Goulburn Group, Northwest Territories, Canada L.P. Tremblay
Geol. Surv. Can., Paper 58-2	Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains, Northwest Territories. J.A. Jeletzky	Geol. Surv. Can., Paper 67-53	Reconnaissance Devonian stratigraphy of northern Yukon Territory and northwestern District of Mackenzie A.W. Norris
		Geol. Surv. Can., Paper 68-25	Subsurface geology, Lower Mackenzie River and Anderson River area, District of Mackenzie E.J. Tassonyi
		Geol. Surv. Can., Paper 68-36	Preliminary notes on the Proterozoic Hurwitz Group, Tavani and Kaminack Lake areas, District of Keewatin R.T. Bell

Geol. Surv. Can., Paper 68-42	Stratigraphy of the Lower Proterozoic (Aphebian) Great Slave Supergroup, East Arm of Great Slave Lake, District of Mackenzie P.F. Hoffman	Geol. Surv. Can., Paper 72-19	Description of Carboniferous and Permian stratigraphic sections, northern Yukon Territory and North-western District of Mackenzie E.W. Bamber
Geol. Surv. Can., Paper 68-47	Sekwi Formation, a new Lower Cambrian formation in the southern Mackenzie Mountains, District of Mackenzie R.C. Handfield	Geol. Surv. Can., Paper 72-38	Biostratigraphic determinations of fossils from the subsurface of the Yukon Territory and the Districts of Franklin, Keewatin and Mackenzie. B.S. Norford, W.W. Brideaux, T.P. Chamney, M.J. Copeland, Hans Frebold, William S. Hopkins, Jr., J.A. Jeletzky, B. Johnson, D.C. McGregor, A.W. Norris, A.E.H. Pedder, E.T. Tozer and T.T. Uyeno
Geol. Surv. Can., Paper 69-9	Stanton Map-area, (107D) Northwest Territories C.J. Yorath and H.R. Balkwill		
Geol. Surv. Can., Paper 70-12	Geology, Colville Lake map-area and part of Cooper-mine map-area (96 NW And NE, part of 86 NW) Northwest Territories (Report and Map 12-1970) D.G. Cook and J.D. Aitken	Inter Sym. On Dev. System A.S.P.G.	Upper Denovian ostracod faunas of Great Slave Lake and northeastern Alberta, Canada W.K. Braun
Geol. Surv. Can., Paper 70-13	Lower and Middle Devonian stromatoporoids from northwestern Canada C.W. Stearn and P.N. Mehrotra	Inter Sym. On Dev. Systems A.S.P.G.	Ambocoeliid brachiopods from the Middle Devonian rocks of northern Canada W.G.E. Caldwell
Geol. Surv. Can., Paper 70-14	Middle Devonian tectonic history of the Tathlina Uplift, southern District of Mackenzie and northern Alberta, Canada. H.R. Belyea	Inter Sym. On Dev. Systems A.S.P.G.	Devonian of northern Yukon Territory and adjacent District of Mackenzie A.W. Norris
Geol. Surv. Can., Paper 70-30-	Tertiary and Cretaceous Biostratigraphic Divisions in the Reindeer D-27 Borehole, Mackenzie River Delta T.P. Chamney	Bulletin of Can. Petroleum Geology Vol. 18, No. 1, pp. 67-79	Ramparts, Beavertail and other Devonian Formations C.H. Crickmay
		Bulletin of Can. Petroleum Geology Vol. 18, No. 1, pp. 80-83	Clay-Mineralogy and Boron Determinations of the Shales from the Reindeer Well, Mackenzie River Delta P. Bayliss and A.A. Levinson
Geol. Surv. Can., Paper 70-32	Brock River map-area, District of Mackenzie (97D) H.R. Balkwill and C.J. Yorath, (Report and Map 13-1970)	Bulletin of Can. Petroleum Geology Vol. 19, No. 2, pp. 437-484	Regional Devonian Geology and Oil and Gas Possibilities, Upper Mackenzie River Area James Law
Geol. Surv. Can., Paper 71-11	Reconnaissance geology, southern Great Bear Plain, District of Mackenzie H.R. Balkwill (Report and Map 5-1971)	Bulletin of Can. Petroleum Geology Vol. 19, No. 3, pp. 570-588	Facies and Faunal Relations at Edge of Early Mid-Devonian Carbonate Shelf, South Nahanni River Area, N.W.T. J.P.A. Noble and R.D. Ferguson
Geol. Surv. Can., Paper 71-15	Biostratigraphic determinations of fossils from the subsurface of the Yukon Territory and the District of Mackenzie, B.S. Norford, M.S. Barss, W.W. Brideaux, T.P. Chamney, W.H. Fritz, William S. Hopkins, Jr., J.A. Jeletzky, A.E.H. Pedder and T.T. Uyeno	Geol. Surv. Can., GSC Maps 1316A, 1317A, 1318A	Oil and Gas Pools of Western Canada N.L. Ball
		Bulletin of Can. Petroleum Geology Vol. 20, No. 2, pp. 321-361	Ordovician to Devonian History of Northern Yukon and adjacent District of Mackenzie A.C. Lenz

Bulletin of Can. Petroleum Geology Vol. 20, No. 3, pp. 498-548	The Horn Plateau Formation: A Middle Devonian Coral Reef. Northwest Territories Canada L.K. Vopni and J.F. Lerbekmo		B.S. Norford, M.S. Barss, W.W. Brideaux, T.P. Chamney, W.H. Fritz, Williams S. Hopkins, Jr., J.A. Jeletzky, A.E.H. Pedder and T.T. Uyeno
<i>Eagle Plain and Northern Yukon</i> Geol. Surv. Can., Memoir 247	Physiography of the Canadian Cordillera with a Special Reference to the Area North of the Fifty-Fifth Parallel H.S. Bostock	Geol. Surv. Can., Paper 72-38	(see page 3 of Appendix V)
Geol. Surv. Can., Paper 61-9	Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell River, Yukon Territory J.A. Jeletzky	Inter Sym. On Dev. Systems A.S.P.G.	Upper Silurian and Lower Devonian biostratigraphy, Royal Creek, Yukon Territory, Canada A.C. Lenz
Geol. Surv. Can., Paper 63-39	Reconnaissance of the Ordovician and Silurian Rocks of Northern Yukon Territory B.S. Norford	Bulletin of Can. Petroleum Geology Vol. 18, No. 3, pp. 407-429	Age and Fauna of the Michelle Formation, Northern Yukon Territory R. Ludvigsen
Geol. Surv. Can., Paper 66-39	Descriptions of Devonian Sections in Northern Yukon and Northwestern District of Mackenzie A.W. Norris	Bulletin of Can. Petroleum Geology Vol. 19, No. 1, pp. 29-249	Carboniferous and Permian Stratigraphy and Paleontology, Northern Yukon Territory, Canada E.W. Bamber and J.B. Waterhouse
Geol. Surv. Can., Paper 67-53	Reconnaissance Devonian Stratigraphy of Northern Yukon Territory and Northwestern District of Mackenzie A.W. Norris	<i>Sverdrup Basin</i> Geol. Surv. Can., Memoir 320	Geology of the North Central Part of the Arctic Archipelago, Northwest Territories (Operation Franklin) Y.O. Fortier et al.
Geol. Surv. Can., Paper 68-18	Stratigraphy and Palynology of a Permian Section, Tatonduk River, Yukon Territory E.W. Bamber and M.S. Barss	Geol. Surv. Can., Memoir 331	Geological Reconnaissance of Northeastern Ellesmere Island, — District of Franklin R.L. Christie
Geol. Surv. Can., Paper 68-26	Lower Cretaceous (Albian) of the Yukon: Stratigraphy and Foraminiferal subdivisions, Snake and Peel Rivers E.W. Mountjoy and T.P. Chamney	Geol. Surv. Can., Memoir 332	Western Queen Elizabeth Islands, Arctic Archipelago E.T. Tozer & R. Thorsteinsson
Geol. Surv. Can., Paper 70-15	Biostratigraphic determinations of fossils from the subsurface of the Yukon Territory and the Districts of Mackenzie and Franklin B.S. Norford, W.K. Braun, T.P. Chamney, W.H. Fritz, D.C. McGregor, A.W. Norris, A.E.H. Pedder and T.T. Uyeno	Geol. Surv. Can., Paper 60-7	Summary Account of Structural History of the Canadian Arctic Archipelago since Precambrian Time R. Thorsteinsson and E.T. Tozer
Geol. Surv. Can., Paper 71-15	Biostratigraphic determinations of fossils from the subsurface of the Yukon Territory and the District of Mackenzie	Geol. Surv. Can., Paper 63-30	Mesozoic and Tertiary Stratigraphy, Western Ellesmere Island and Axel Heiberg Island E.T. Tozer
		Geol. Surv. Can., Paper 66-34	Lower Triassic Tar Sands of Northwestern Melville Island, Arctic Archipelago H.P. Trettin and L.V. Hills
		Geol. Surv. Can., Paper 66-55	Ordovician Stratigraphic Section at Daly River, Northeast Ellesmere Island, District of Franklin B.S. Norford

Geol. Surv. Can., Paper 67-27 pt I	Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada. Proterozoic and Cambrian J. Wm. Kerr	Department of Energy, Mines & Resources, scale: 1:1,000,000	Glacier map of northern Queen Elizabeth Islands (District of Franklin) W.E. Henock and A. Stanley
Geol. Surv. Can., Paper 67-27 pt II	Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada, Ordovician J. Wm. Kerr	Bullet of Can. Petroleum Geology Vol. 13, No. 1, March 1965	Lower Paleozoic Salt, Canadian Arctic Islands R.H. Workum
Geol. Surv. Can., Paper 68-16	Ellef Ringnes Island, Canadian Arctic Archipelago D.F. Stott	Bulletin of Can. Petroleum Geology Vol. 12, No. 3, Sept. 1964	Piercement Structures in the Arctic Islands Don B. Gould & George de Mille
Geol. Surv. Can., Paper 68-17	Mesozoic and Tertiary stratigraphy at Lake Hazen, northern Ellesmere Island, District of Franklin A.A. Petryk	Bulletin of Can. Petroleum Geology Vol. 19, No. 3, pp. 659-679	Geology of the Sverdrup Basin B.P. Plauchut
Geol. Surv. Can., Paper 68-31	Upper Paleozoic and Mesozoic Stratigraphy in the Yelverton Pass Region, Ellesmere Island, District of Franklin W.W. Nassichuk and R.L. Christie	Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp. 705-729	Upper Devonian Stratigraphy, Northeastern Banks Island, N.W.T. J.E. Klován and A.F. Embry III
Geol. Surv. Can., Paper 68-44	Analysis of aeromagnetic data over the Arctic Islands and Continental Shelf of Canada B.K. Bhattacharyya	Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp. 730-781	A Late Devonian Reef Tract on Northeastern Banks Island, N.W.T. Ashton F. Embry III and J.E. Klován
Geol. Surv. Can., Paper 71-12	Reconnaissance of Lower Paleozoic geology, Phillips Inlet region, north coast of Ellesmere Island, District of Franklin H.P. Trettin	Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp. 782-798	Brachiopoda of the Melville Island Group (Upper Devonian), Banks Island, N.W.T. Jonathan W. Harrington
GSC Bull 171	Pre-Mississippian Geology of Northern Axel Heiberg and NW Ellesmere Islands, Arctic Archipelago H.P. Trettin	Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp. 799-811	Upper Devonian Megaspores, Northeastern Bank Island, N.W.T. L.V. Hills, R.E. Smith and A.R. Sweet
GSC Bull 183	Geology of Ordovician to Pennsylvanian Rocks, M'Clintock Inlet, north coast of Ellesmere Island, Arctic Archipelago H.P. Trettin	Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp. 812-813	Mineralogy of the Upper Devonian Strata Along Northeastern Banks Island, N.W.T. P. Bayliss
GSC Bull 203	Geology of Lower Paleozoic formations, Hazen Plateau and southern Grant Land Mountains, Ellesmere Island, Arctic Archipelago H.P. Trettin	Can. J. Earth Sci. Vol. 18, No. 4, pp. 463-468	Geology of an outstanding aerial photograph at Cape Storm, Southern Ellesmere Island, Arctic Canada J. Wm. Kerr
GSC Map 10-1968	Southern Ellesmere Island, District of Franklin J.Wm. Kerr	AAPG Memoir 8 pp. 183-214	Piercement structures in Canadian Arctic Islands (In Diapirism and diapirs — a symposium: American Association of Petroleum Geologists) D.B. Gould and G. DeMille
		Bull. Can. Petroleum Geology Vol. 20, No. 1, pp. 175-183	Geology of outstanding Arctic aerial photographs, Schei Summit area, Central Ellesmere Island J. Wm. Kerr

- In Journal of Glaciology, Vol. 8, No. 52, pp. 23-50
Glacial features of Tanquary Fiord and adjoining areas of northern Ellesmere Island, N.W.T.
G. Hattersley-Smith
- Oilweek, Vol. 20, No. 1, pp. 73-75
Bright glitter of Arctic black gold
H. Heise
- Inter Sym. On Dev. System A.S.P.G.
Devonian of the Franklin miogeosyncline and adjacent Central Stable Region, Arctic Canada
J.W. Kerr
- Inter Sym. On Dev. System A.S.P.G.
Devonian on the Franklinian eugeosyncline
H.P. Trettin
- Bulletin of Can. Petroleum Journal Vol. 20, No. 4, pp. 651-658
Permian-Triassic Boundary in the Canadian Arctic Archipelago
W.W. Nassichuk, R. Thorsteinsson and E.T. Tozer
- Arctic Coastal Plains and Continental Shelf*
Geol. Surv. Can., Paper 63-22
Marine Geology, Eastern Part of Prince Gustaf Adolf Sea, District of Franklin
J.L. Marlowe
- Geol. Surv. Can., Paper 68-27
Geology of the eastern part of the northern interior and Arctic Coastal Plains, Northwest Territories
C.J. Yorath, H.R. Balkwill and R.W. Klassen
- Geol. Surv. Can., Paper 71-21
Massive ice and icy sediments throughout the Tuktoyaktuk Peninsula, Richard Island, and nearby areas, District of Mackenzie
V.N. Rampton and J. Ross Mackay
- Defense Research Board
Ice Atlas of Arctic Canada
C. Swinbank
- Arctic Lowlands*
Geol. Surv. Can., Paper 63-44
Surficial Geology of Boothia Peninsula and Somerset, King William and Prince of Wales Islands, District of Franklin
B.G. Craig
- Geol. Surv. Can., Paper 64-47
Lower Palaeozoic Sediments of Northwestern Baffin Island, District of Franklin
H.P. Trettin
- In Arctic, Vol. 21, No. 2, pp. 84-91
The Peel Sound Formation (Devonian of Prince of Wales and adjacent Islands) — a preliminary report
D.S. Broad and others
- In Can. Journal of Earth Science, Vol. 5, No. 4, pt 1 pp. 791-799
Sedimentary and paleontological features of the Tertiary-Cretaceous rocks of Somerset Island, Arctic Canada
D.L. Dineley and B.R. Rust
- In Journal of Paleontology Vol. 43, No. 1, pp. 1-27
Yukon Territory and Devon Island, Canada, with a section on Devon Island stratigraphy, by A.R. Ormiston
G. Klapper
- GSC Map 6-1969 (with notes)
Lac Belot map-area, Northwest Territories.
J.D. Aitken and D.G. Cook
- Journal of Paleontology
Helicoprion sp. and Ellasmonbranch found in Permian rocks on Ellesmere Island, Canadian Arctic
W.W. Nassichuk and Claude Spinoso
- In Maritime Sediments, Vol. 4, No. 2, pp. 69-72
The submersibles PICES feasibility study in the Canadian Arctic
B.R. Pelletier
- Bull. Geol. Soc. Am. Vol. 80, No. 1, Jan. 1969, pp. 143-148
A Paleozoic-Tertiary Fold Belt in northernmost Ellesmere Island aligned with the Lomonosoy Ridge
H.P. Trettin
- In Micropaleontology Vol. 15, No. 1, pp. 35-60
Recent foraminifera in the Canadian Arctic
G. Vilks
- Geol. Surv. Can., Paper 72-37
Description, Palynology and Paleooecology of the Hassall Formation (Cretaceous) on eastern Ellef Ringnes Island, District of Franklin
W.S. Hopkins, Jr., and H.R. Balkwill
- In Journal of Paleontology Vol. 43, No. 1, pp. 28-40
Permian Strophalosiidae (Brachiopoda) from the Canadian Arctic Archipelago
J.B. Waterhouse
- Can. Journal of Earth Sciences Vol. 9, No. 6
Geophysical and Geological Studies in Eastern and Northern Baffin Bay and Lancaster Sound
M.S. Keen, S. Johnson, I. Park
- Franklinian Geosyncline*
Geol. Surv. Can., Memoir 294
Cornwallis and Little Cornwallis Islands, District of Franklin, Northwest Territories
R. Thorsteinsson
- Geol. Surv. Can., Memoir 309
Permian Rocks and Faunas of Grinnell Peninsula, Arctic Archipelago
P. Harker and R. Thorsteinsson

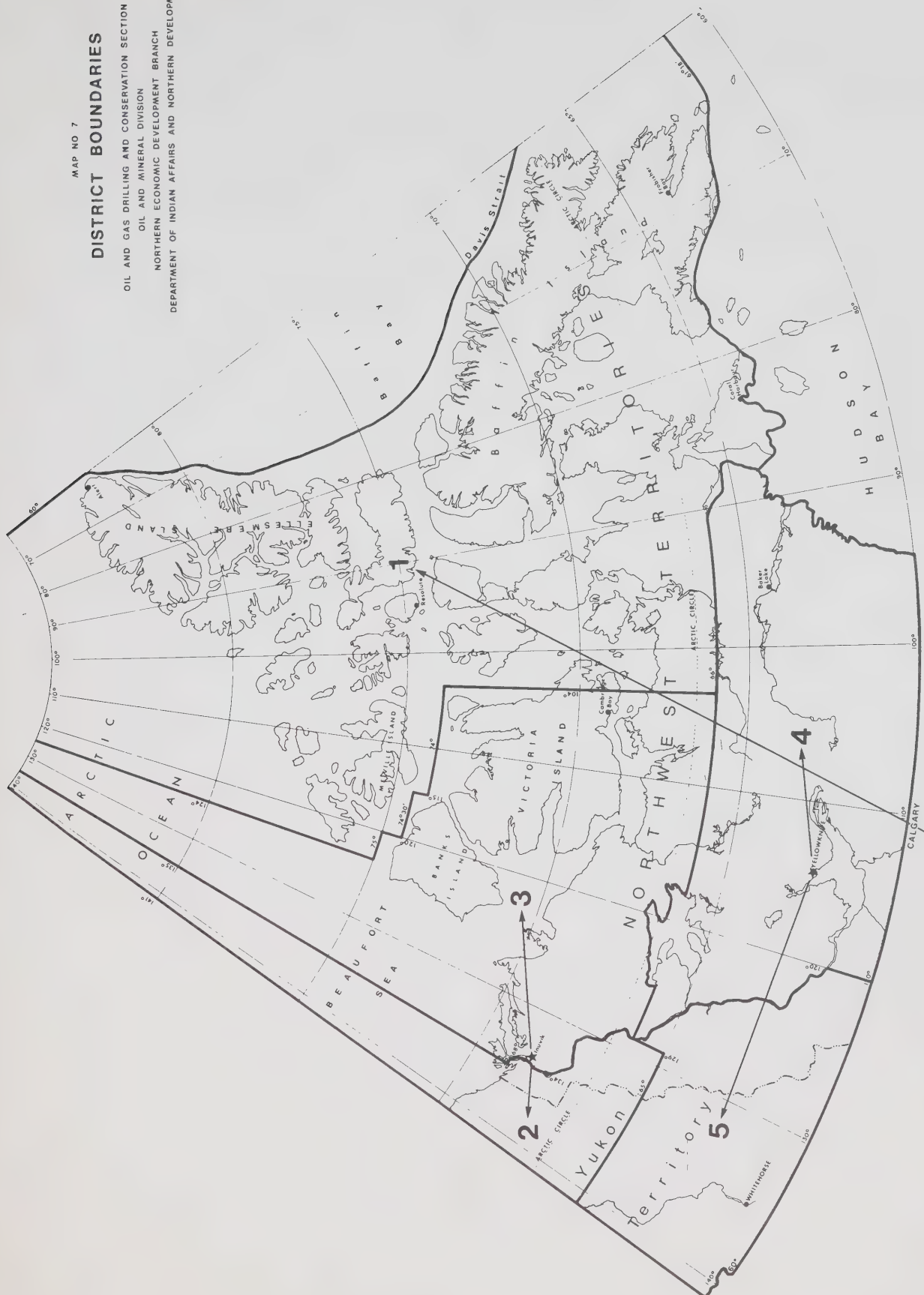
Geol. Surv. Can., Memoir 316	Triassic Stratigraphy and Faunas, Queen Elizabeth Islands, Arctic Archipelago E.T. Tozer	Geol. Surv. Can., Paper 60-20	Belcher Islands, Northwest Territories G.D. Jackson
Geol. Surv. Can., Memoir 330	Banks, Victoria and Stefansson Islands, Arctic Archipelago (Report and Map 1135A) R. Thorsteinsson and E.T. Tozer	Geol. Surv. Can., Paper 63-48	Sedimentology of Hudson Bay, District of Keewatin R.J. Leslie
Bulletin Canadian Petroleum Geology Vol. 15, No. 1	New Nomenclature of Ordovician Rock Units of the Eastern and Southern Queen Elizabeth Islands, Arctic Canada J. Wm. Kerr	Geol. Surv. Can., Paper 67-24	Stratigraphic sections of Palaeozoic Rocks on Prince of Wales and Somerset Islands, District of Franklin, N.W.T. R.L. Christie
Bulletin Canadian Petroleum Geology Vol. 13, No. 1	Middle Ordovician to Middle Silurian Carbonate Cycle, Brodeur Peninsula, Northwestern Baffin Island H.P. Trettin	Geol. Surv. Can., Paper 67-60	Geology of the Hudson Bay Lowlands, Operations Winisk B.V. Sanford, A.W. Norris and H.H. Bostock
<i>Foxe Basin and Baffin Island</i> Geol. Surv. Can., Paper 62-35	Notes with Map 3 — 1958 and Map 4 — 1958 (Fury and Hecla Strait; Foxe Basin North) R.G. Blackadar	Geol. Surv. Can., Paper 69-8	Ordovician and Silurian bio- stratigraphy of the Sogepet-Aquitaine Kaskattama Province No. 1 well, northern Manitoba B.S. Norford
Geog. Bull. 4 pp. 1-29	The Island in Foxe Basin; Geog. Br. Department of Mines and Technical Surveys	Geol. Surv. Can., Bulletin 164	Silurian cephalopods of James Bay Lowland, with a revision of the family Nartheocerotidae R.H. Flower
Geol. Surv. Can., Paper 64-47	Lower Palaeozoic Sediments of North- western Baffin Island, District of Franklin H.P. Trettin	In Can. Journal of Earth Sciences, Vol. 5, No. 5, pp. 1297-1303	An analysis of the crust-mantle boundary in Hudson Bay from gravity and seismic observations J.R. Weber and A.K. Goodacre
Maritime Sediments Vol. 4, No. 1, pp. 4-6	Sedimentological survey of Baffin Bay J.J. Blee	<i>Additional Maps</i> GSC Map 1298A	Slidre Fiord Map-Area, Ellesmere Island, Canadian Arctic Archipelago R. Thorsteinsson
Geological Survey Bulletin No. 157	Lower Palaeozoic sediments of North- western Baffin Island H.P. Trettin	GSC Map 1299A	Middle Fiord Map-Area, Arctic Islands R. Thorsteinsson
Can. Journal of Earth Sciences Vol. 9, No. 3	Geophysical Studies in Baffin Bay and some Tectonic implications C.E. Keen, D.L. Bassett, K.S. Manchester, and D.I. Ross	GSC Map 1300A	Eureka Sound south Map-Area, Arctic Islands R. Thorsteinsson
Map	Glacier map of southern Baffin Island... and northern Labrador Peninsular (Department of Energy, Mines and Resources, scale 1:1,000,000) 1968	GSC Map 1301A	Strand Fiord Map-Area, Arctic Islands R. Thorsteinsson
<i>Hudson Bay Basin and Lowlands</i> Geol. Surv. Can., Paper 59-13	Aeromagnetic Surveys Across Hudson Bay from Churchill to Coral Harbour and Churchill to Great Whale River M.E. Bower	GSC Map 1302A	Eureka Sound north Map-Area, Arctic Islands R. Thorsteinsson
		GSC Map 1303A	Haig-Thomas Island Map-Area, Arctic Islands R. Thorsteinsson

GSC Map 1304	Glacier Fiord Map-Area, Arctic Islands R. Thorsteinsson
GSC Map 1305A	Cape Stallworthy Map-Area, Arctic Islands R. Thorsteinsson
GSC Map 1306A	Tanquary Fiord Map-Area, Arctic Islands R. Thorsteinsson
GSC Map 1307A	Strathcona Fiord-Area, Arctic Islands

MAP NO 7

DISTRICT BOUNDARIES

OIL AND GAS DRILLING AND CONSERVATION SECTION
OIL AND MINERAL DIVISION
NORTHERN ECONOMIC DEVELOPMENT BRANCH
DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT





Indian and
Northern Affairs

Affaires indiennes
et du Nord

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Oil and Gas
Activities 1973



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Oil and Gas Activities 1973

Government
Publications

Canada, Dept. of Indian Affairs and Northern Development
Northwest Territories

**A Report of Activities in 1973 of the
Oil and Gas Industry in the Yukon
Territory and Northwest Territories**

Compiled by Oil and Gas Land and
Exploration Section
Oil and Minerals Division
Northern Natural Resources and Environment Branch.

(Edition No. 10)

Issued under the authority of
Hon. Jean Chrétien, PC, MP, Minister of
Indian and Northern Affairs
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Catalogue No. R71-6/1973
IAND Publication No. QS-1551-000-EE-A1



First Well to be Drilled on Man Made Island in offshore Canada

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Introduction

All aspects of oil and gas operations in the Yukon and Northwest Territories are administered by the Department of Indian and Northern Affairs, specifically by the Oil and Minerals Division. It is the intent of the Department to provide a regulatory climate that will best encourage and provide for the orderly exploration and exploitation of oil and gas, thereby achieving benefits of a local nature to the specific areas involved and to the people of Canada in general through the attendant revenues accruing to the Crown.

The Minister and officers of the Department of Indian and Northern Affairs, responsible for administering oil and gas resources in the Northwest Territories and Yukon Territory, and northern offshore areas, as of March 1, 1974 were:

- Minister — The Hon. Jean Chrétien, P.C., M.P.
- Deputy Minister — H.B. Robinson
- Assistant Deputy Minister (Northern Affairs) — A.D. Hunt
- Director, Northern Natural Resources and Environment
 - Branch — F.J. Joyce
- Assistant Director, Oil and Minerals Division —
 - Dr. H.W. Woodward

Oil and Gas Land and Exploration Section
Administrator, Oil and Gas — R.R. McLeod
Head, Geological Operations Unit — S.A. Kanik
Head, Geological Evaluation Unit — Dr. J. Brindle
Head, Land Unit — P. Sullivan

Oil and Gas Drilling and Conservation Section
Chief Petroleum Engineer —
Head, Drilling and Completion Engineering Unit — M.K. El-Defrawy
Head, Offshore Petroleum Engineering Unit — S.V. Benediktson
Head, Production Systems Engineering Unit — R.L. Price
Head, Reservoir Engineering Unit —
Regional Oil and Gas Conservation Engineer, N.W.T.

- M.D. Thomas in Yellowknife

Regional Oil and Gas Conservation Engineer, Y.T.

- A.F. Halcrow in Whitehorse

District Oil and Gas Conservation Engineers —

- for Arctic Islands In Calgary, District 1, N.W.T.
- G.E. Blue for Southern Sector, N.W.T. in Yellowknife, District 2, N.W.T.
- J. Kirk for the N.W. Sector, N.W.T. onshore in Inuvik, District 3, N.W.T.
- for the N.W.T. Offshore, in Inuvik, District 4, N.W.T.

Potential of the Geologic Basin

Geological Summaries

In Canada, north of latitude 60°, the land area not covered by sea and outside the provinces covers 1,458,784 square miles. Of this area a total of 465,000 square miles are underlain by sedimentary rocks (Map No. 1). The vast sedimentary region, including the area covered by seas, is divided for convenience into geological provinces as set out below. These are briefly described, and a selected list of references provided for those who wish for further information concerning them.

1. Arctic Stable Platform
2. Franklinian Geosyncline
3. Sverdrup Basin
4. Arctic Coastal Plain
5. Baffin Bay — Davis Strait Basin
6. Banks Basin
7. Mackenzie — Beaufort Basin
 - a) Mackenzie Delta
 - b) Beaufort Sea
8. Interior Plains (Part of the Western Canada Sedimentary Basin)
 - a) Great Slave Plain
 - b) Great Bear Plain
 - c) Peel Plain
 - d) Anderson Plain
 - e) Mackenzie Plain
9. Liard Plateau
10. Eagle Plain
11. Peel Plateau
12. Old Crow Basin
13. Whitehorse Basin

1. *Arctic Stable Platform*

The Arctic Stable Platform lies between the Canadian Shield to the south and the Franklinian geosyncline to the north and west. The area is underlain by thin, gently dipping, relatively undisturbed, Lower Paleozoic, carbonates which overlie the craton and thicken northward towards the geosyncline. Three cratonic arches extend northward from the Shield and divide the Lowlands into several individual basins, the Foxe Basin being the one farthest to the east. To the end of 1973, two unsuccessful tests had been drilled within the Arctic Stable Platform Province.

2. *Franklinian Geosyncline (Arctic Fold Belt)*

The limits of Paleozoic deformation define the division between the Franklinian geosyncline and the Arctic Lowlands to the south and east. The geosyncline was the site of continuous sedimentation from Cambrian to Upper Devonian time. Two depositional belts are recognized; a miogeosynclinal belt extending from Banks Island to northern

Greenland, and a eugeosynclinal belt exposed only on Axel Heiberg and Ellesmere Island. Thick carbonates and clastics constitute potential reservoirs. Strata were folded in the Ellesmerian orogeny of Late Devonian or Early Carboniferous time; these folded strata constitute the basement underlying the Sverdrup basin. No commercial production has been discovered to date. An encouraging show of light gravity crude was recovered from a well on Cameron Island.

3. *Sverdrup Basin*

A major angular unconformity marks the base of the Sverdrup Basin stratigraphic succession; Lower Pennsylvanian to Tertiary strata overlie folded Paleozoic strata of the Franklinian geosyncline. The structural and stratigraphic axis of the Sverdrup Basin strikes northeast from Banks Island to northern Ellesmere Island; the thickest accumulation of sediment in the basin, in excess of 25,000 feet, is found along this axis. The sediments, which contain a number of unconformities, thin in all directions away from this axis. The sedimentary accumulation thus has the form in both a structural and stratigraphic sense, of an elongate basin, to which the name Sverdrup Basin has been applied. Thickness and facies indicate that the present south and east limits of the basin are close to the original depositional limits; Tertiary strata of the Arctic Coastal Plain mask the northern and western margins. Evaporites of late Paleozoic age form piercement structures in the axial area of the basin. The lower part of the Upper Cretaceous series and older sediments are intruded by igneous sills and dikes of varying thickness, the igneous activity was concentrated in the eastern half of the basin. The Eurekan Orogeny in latest Cretaceous and early Tertiary time produced folding and faulting throughout the basin; deformation was accompanied by emplacement or reactivation of the piercement bodies. The magnitude of the deformation increases toward the northeast margin of the Basin. Thick arenaceous sequences, particularly in the Jurassic and Triassic, contain hydrocarbon reserves. Six gas fields have been discovered to date within the Sverdrup Basin. In chronological order of discovery they are: Drake Point; King Christian; Kristoffer Bay; Hecla; Wallis; and Thor. Recoveries of free crude oil have been recorded from Ellesmere and Thor Islands.

4. *Arctic Coastal Plain*

The north and west margins of the Sverdrup Basin, both on land and in the offshore, are masked by thick, relatively undisturbed, Tertiary and Pleistocene clastics. Beds dip gently towards, and thicken on the continental shelf and slope. In this area the continental shelf is approximately 100 miles wide. The continental slope is approximately the

A horizontal scale bar labeled "SCALE OF MILES" with markings at 0, 100, 200, and 300.



same width and lies between 600 and 3,000 meters water depth, inshore of the Canada Basin. Mesozoic strata, underlying the Tertiary and Pleistocene clastics, have an untested potential. In this area the permanent ice cover on the Arctic Ocean has hindered exploration. The thick sequence of clastics of the coastal plain and the thicker offshore equivalents must be considered as having a high potential for hydrocarbon accumulation.

5. *Baffin Bay — Davis Strait Basin*

The Baffin Bay — Davis Strait basinal area is entirely in the offshore and has been explored to date only by regional geophysical surveys. Several theories to explain the origin of the basin have been advanced; a widely accepted one involves continental drift by which Greenland and the Baffin land mass rotated apart from a pivotal point to the northwest. Geophysical surveys have demonstrated that the basin is underlain by oceanic crust, that no mid basin ridge has been found, and as much as 25,000 feet of semi-consolidated clastics are present. Sediments thin to zero in near shore areas and on the Davis Strait Sill. Rocks outcropping around the basin margins are predominantly Precambrian. Major centres of deposition are the Thule Basin, Lancaster Delta and the Cumberland Delta. The central portion of the basin is underlain by up to 20,000 feet of flat-lying, relatively undisturbed sediments. Lancaster Sound and Jones Sound are structurally controlled grabens in which thick deltaic clastics accumulated. Sediment source area was to the west; a major Tertiary drainage system transported sediment to the Baffin basin. The large volume of geologically young sediments and the presence of favourable trapping conditions for hydrocarbons make the Baffin Bay — Davis Strait area a favourable one for future hydrocarbon production.

6. *Banks Basin*

The Banks Basin occupies the central and west-central part of Banks Island and the adjacent coastal plains. Tertiary and Cretaceous clastics overlie mainly lower and Middle Devonian sediments over much of the area. Proterozoic rocks of the Minto Arch occur at the southernmost tip. The sediments of the Banks Basin have not yet been adequately tested by drilling, but the presence of large volumes of young sediments and the reefal facies of the Siluro-Ordovician carbonates make the area one of high potential for hydrocarbon accumulation.

7. *Mackenzie — Beaufort Basin*

The Mackenzie Delta — Beaufort Sea petroleum province is made up of thick deposits of potentially productive Cretaceous and Tertiary sands.

The Mackenzie Delta, the southern portion of the Mackenzie — Beaufort Basin, is bounded by the Romanzof uplift to the southwest, the Richardson Mountains to the south, the Aklavik arch to the southeast and the Arctic Sea to the north. The Beaufort Sea is one of several formally named, marginal embayments with wide continental shelves that occur as indentations in the coastline of the Arctic

Ocean. The Coastal Plain, which lies adjacent to the Beaufort Sea, is laterally continuous with the continental shelf and is considered as the onshore, exposed extension of the Beaufort Sea shelf. The Beaufort Sea petroleum province is connected to the mainland of the Yukon through the Yukon Coastal plain, and to the Mackenzie Delta and Banks Island through the Mackenzie Delta plain and the Banks Coastal plain.

Growth faults extend seaward from the Mackenzie Delta across the coastal plain. Potential reservoir rocks, which include non-marine and marine sandstones and carbonate rocks are transitional with shales that are potential source rocks.

Oil is found in Paleozoic carbonates, Lower Cretaceous sands and Tertiary sands at Mayogiak, Atkinson, Kugpik, Ivik and Adgo pools.

Gas is found in Cretaceous and Tertiary sands at Mallik, Niglintgak, Parsons, Taglu, Ya Ya, Reindeer and Titalik pools.

8. *Interior Plains*

a) *Great Slave Plain*

The Great Slave Plain encompasses an area extending westward from the Great Slave Lake to the Liard Plateau and Mackenzie Mountains. Underlying strata are mainly of Devonian age, obscured in part by remnants of a thick Cretaceous cover. The total sediments wedge from zero feet in thickness to the east to greater than 10,000 feet westward into the mountain belt. Gas pools are found at Bovie Lake, Cameron Hills, Celibeta, Netla, Rabbit Lake, South Island River and at Trainor Lake. The gas occurs in porous dolomites and limestones of Middle Devonian age.

b) *Great Bear Plain*

The Great Bear Plain consists of Lower and Upper Cretaceous sediments partially covering a bedrock of Ordovician to Devonian age. The total sediments wedge from zero feet in thickness to the east to more than 6,000 feet in the west along the eastern edge of the Franklin Mountains.

c) *Peel Plain*

The Peel Plain lies to the northeast of the Peel Plateau and northwest of the Mackenzie Plain. The Plain is covered by Cretaceous and Jurassic sediments which overlie Paleozoic carbonates and shales. The sediments are similar to those of the Mackenzie Plain and range in thickness from more than 14,000 feet in the southwest to 8,000 feet in the northeast. Hydrocarbon shows have been encountered in the Lower Devonian.

d) *Anderson Plain*

The Anderson Plain lies east of the Mackenzie Delta. Cretaceous beds cover much of the Plain area and lie unconformably on lower and middle Paleozoic beds. Sediments of more than 8,000 feet in thickness occur in a southwest-northeast trend through the wells C.P.O.G. Kugaluk N-02 and Elf Horton River G-02. Hydrocarbon shows have been encountered in the Cretaceous.

e) Mackenzie Plain

The Mackenzie Plain lies between the Franklin and Mackenzie Mountains. Cretaceous beds lie unconformably on lower and middle Paleozoic beds. Sediments range in thickness from 4,000 feet to 9,000 feet. Oil is produced in the Mackenzie Plain at Norman Wells. The producing formation is the Devonian Kee Scarp. Additional hydrocarbon shows have been encountered in the Cretaceous and Silurian.

9. Liard Plateau and Range

The Liard Plateau and Range lie west of the southern portion of the Great Slave Plain and northwest of the Fort Nelson Lowland. A thin Cretaceous cover lies unconformably on Paleozoic beds. Sediment thickness exceeds 10,000 feet. The Beaver River and Pointed Mountain fields produce gas from dolomites of the Nahanni Formation of Middle Devonian age. Production comes from large faulted anticlines near the western edge of the Great Slave Plain.

10. Eagle Plain

The Eagle Plain basin is contained between the Ogilvie and Richardson Mountains, with sediments approaching 20,000 feet in thickness of which about 10,000 feet are late Paleozoic to Mesozoic in age, the remainder being Cenozoic. This basin has been tectonically altered.

Gas and oil have been found in Pennsylvanian sand at the Chance Pool, and gas in Cretaceous sands at the Chance, Birch and Blackie pools. Hydrocarbon shows were also encountered in Mississippian, Devonian and Ordovician beds.

11. Peel Plateau

The Peel Plateau is bounded on the northwest and east by the Peel Plain, on the south by the Mackenzie Mountains, and on the west by the Richardson Mountains. The Plateau is covered by Tertiary and Cretaceous clastics unconformably overlying Paleozoic shales and carbonates. The sediments range in thickness from 10,000 feet in the east to 20,000 feet in the west. Shows of hydrocarbons have been encountered in Cretaceous and Middle Devonian strata.

12. Old Crow Basin

The Old Crow Basin is a relatively unexplored intermontane basin covering an area of about 2,400 square miles centered about latitude 68° N and longitude 140° W. Geophysical data indicates a thickness of from 2,000 to 5,000 feet of Mesozoic and Tertiary clastics overlying as much as 10,000 feet of Upper Devonian to Permo-Carboniferous sediments. The Old Crow basin as it now exists was formed by the Laramide orogeny in Tertiary time.

13. Whitehorse Basin

The Whitehorse Basin lies at the northern end of the Central Cordilleran Geosyncline. The basin is about 150

miles long and 70 miles wide and contains up to 15,000 feet of sediments ranging in age from Early Cretaceous to Late Triassic.

Area and Volume of Sediments

A comparison of the sedimentary areas of volumes in the Western Provinces and in the Yukon, Northwest Territories and Arctic Islands is given in Table No. 1.

Table No. 1 — Volume of Sediments

Area	Area (Sq. Miles)	Volume of Sediments (Cu. Miles)
Manitoba and Saskatchewan	220,000	165,000
Alberta	224,700	333,400
British Columbia	138,500	298,000
Yukon and Northwest Territories		
Mainland*	541,500	421,000
Arctic Archipelago**	644,600	1,275,000
	1,789,300	2,492,000

Oil and Gas Discoveries

Appendix II is a complete list of oil and gas discoveries north of Latitude 60° to the end of 1973.

Oil was discovered in the Imperial Ivik J-26, Imperial Ivik K-54 and Shell Kupik O-13 wells, all in the Mackenzie Delta area. Gas and condensate were recovered from the Gulf Mobil Parsons N-10 well. In the Arctic Islands, gas was discovered in the Panarctic et al Thor H-28 well, following up the 1972 oil show in the Panarctic et al Thor P-38 well. Map No. 3 shows the location of all oil and gas fields and discovery wells.

Reserves

The geological basins of the Northwest Territories and Yukon are only in the initial stages of exploration, and definitive reserves of oil and gas would thus have limited meaning. Norman Wells is the sole field producing oil at this time. The field was discovered in 1920, but intensive commercial development did not take place until World War Two. During 1973 oil was produced at an average rate of 2,802 barrels daily and refined locally.

Gas is produced from the Pointed Mountain field, the average daily production being 93,086,000 cubic feet. The gas is piped to the Clarke Lake gas plant in British Columbia. Part of the Beaver River field underlies the Yukon and gas from this field, too, is piped to Clarke Lake:

*Includes Beaufort Sea area, but excludes all Arctic Stable Platform.

**Includes all Arctic Stable Platform and all offshore areas except Beaufort Sea.

The Geological Survey of Canada's 1973 estimates for oil and gas potential in the Northwest Territories are as follows:

	Ultimate Recoverable Oil (Billion Barrels)	Ultimate Recoverable Gas (Trillions Cu. Ft.)
1. Sverdrup Basin		
Land	7.2	118.8
Offshore	4.7	79.2
2. Arctic Fold Belt (Franklinian Geosyncline)		
Land	2.6	15.2
Offshore	1.1	6.8
3. Arctic Stable Platform		
Land	0.6	0.6
Offshore	0.6	0.6
4. Arctic Coastal Plain	3.5	20.8
5. Beaufort — Mackenzie		
Land	3.5	50.0
Offshore	2.7	43.5
6. Mainland N.W.T.	1.7	7.5

The Canadian Petroleum Association in their 1973 Reserves Report attribute the following reserves to the Territories:

(a) Proved crude oil reserves	41,895,000 bbls.
(b) Remaining marketable natural gas reserves	886,239 MMCF
(c) Probable crude oil reserves	71,895,000 bbls.
(d) Probable natural gas reserves	1,153,781 MMCF

Refining Operations

Refinery Capacity

As noted in a previous section the only operating refinery located North of 60 is at Norman Wells and is operated by Imperial Oil Limited. This refinery has a calendar day capacity of 1,500 barrels and a stream day capacity of 1,600 barrels. A continuing modernization program is underway to upgrade the refinery facilities and wharf-loading. In 1973 the refinery processed an average of 2,612 barrels per day of locally produced crude oil.

Activities — Land

Land activities, as may be seen in the Land Map (Map No. 2) and in Table No. 2, were characterized by a degree of stability in total permit and lease holdings.

In 1973, applications for permits were received for some 67,000,000 acres in the Wollaston and Victoria Straits Basins, and offshore of the Western Arctic Islands and Baffin Bay in 1973. The review of the Regulations is currently underway and no permits were granted after March 21, 1972. The issuance of leases was delayed during negotiations between the Federal Government and the Maritime Provinces respecting the administration of East Coast offshore lands. In 1973 about

230 lease applications covering 1,500,000 acres from the Normal Wells area to King Christian Island in the high Arctic were received. Applications for which permits have not been issued now total 108,000,000 acres; 4,200,000 acres in leases are pending.

Table No. 2 — Number of Permits and Leases, and Relevant Acreage December 31, 1973

Area	No. of Permits	Acreage
N.W.T. Mainland	1,770	79,905,301
Yukon Mainland	488	20,775,676
Arctic Islands	5,024	243,599,272
Arctic Coast Marine	1,310	63,413,809
	8,592	407,694,058
Area	No. of Leases	Acreage
N.W.T. Mainland	682	4,095,569
Yukon Mainland	93	427,854
Arctic Islands	NIL	NIL
Arctic Coast Marine	NIL	NIL
	775	4,523,423
Total Permits and Leases	412,217,481 Acres	

The decrease in acreage from 1972, (eight per cent overall) was principally due to maturity of the permits in the Yukon and southern Northwest Territories. The permits issued in the High Arctic in 1969 reached the end of their second period in 1973. The permits issued in 1969 were mostly in the more remote and difficult areas of the high Arctic. Evidence of the high degree of optimism in industry is shown in the majority of these permits being maintained in good standing to the end of their initial term. Approximately 125 million acres of permits issued in 1968 will require further expenditure commitments of \$25 million during 1974. The permits issued in 1970 (24.5 million acres) will also require further commitments in 1974. As a result, about 25 per cent of the holdings will be examined during 1974.

No public offerings of Oil and Gas Rights were made in 1973. The last invitation to tender on Crown Reserve Lands was made in January, 1969.

Oil and Gas Land Regulations

The permit terms under the Canada Oil and Gas Land Regulations are summarized in Figures 3 and 4. Figure 3 shows the term in years, including six annual renewals beyond the initial term and the total per acre minimum work requirements to be met during the maximum permit life. The minimum deposit and work requirements for each period of the permit life is illustrated in Figure 4.

Land Order 1-1961 which was revoked in May 1970, allowed a permittee, in consideration, for the payment of extra royalty, an option for 60 days to select leases, any or all of the sections of his permit which reverted to the Crown after his selection of primary leases. The additional royalty terms under that Order for each area are shown in Figure 5. Some 93 leases granted under the Order were in good standing on December 31, 1973.

Canada Lands are administered by the Department of Indian Affairs and Northern Development north of the heavy line. Offshore areas elsewhere administered by the Department of Energy, Mines and Resources

Map 2 OIL & GAS LAND ACQUISITIONS NORTH OF 60°



- Acquired prior to 1968
- Acquired Jan. 1, 1968 to April, 1972
- Oil Well
- Gas Well

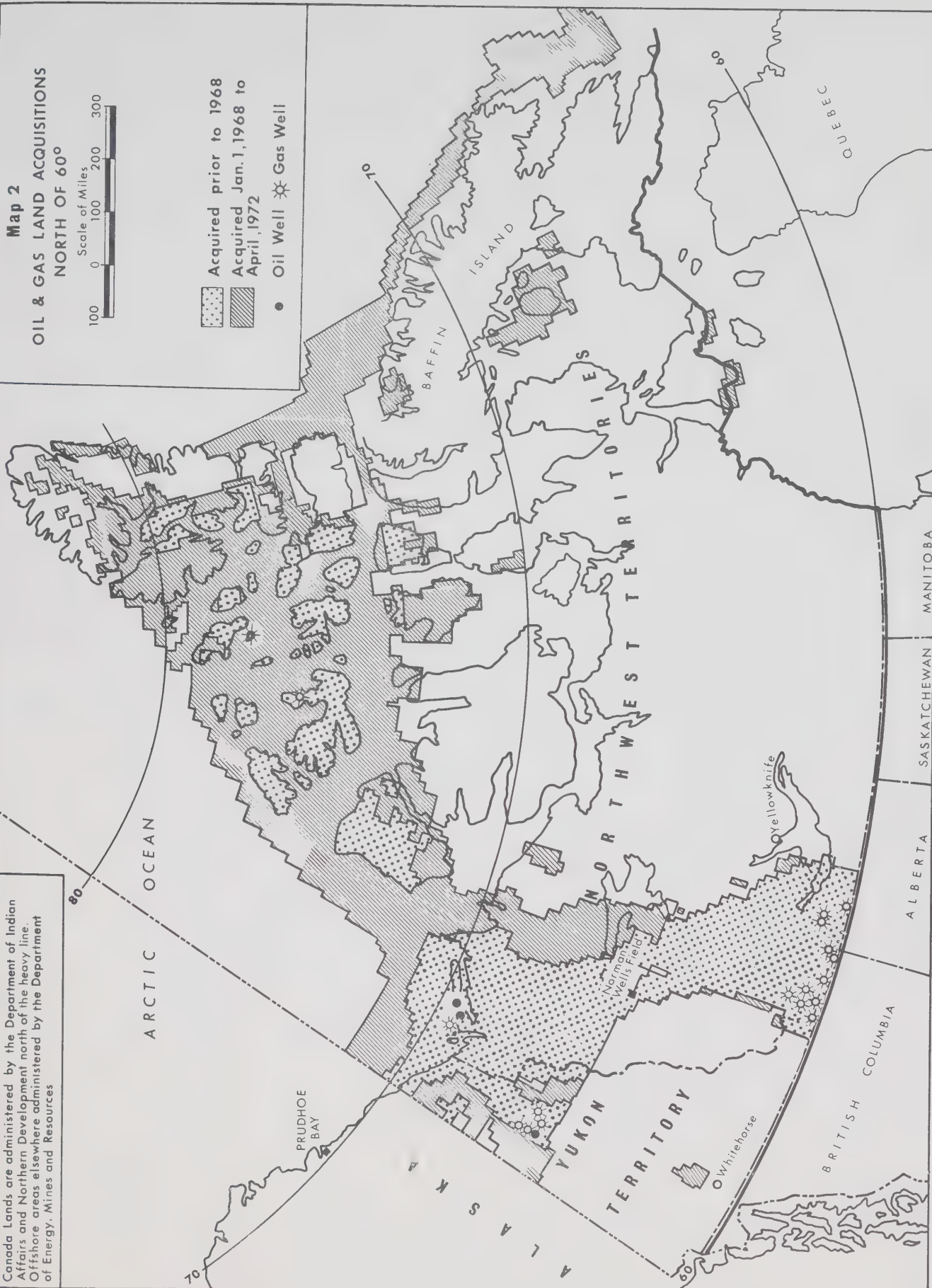


Fig. 1

ACREAGE HELD UNDER OIL & GAS PERMIT

YUKON TERRITORY AND NORTHWEST TERRITORIES

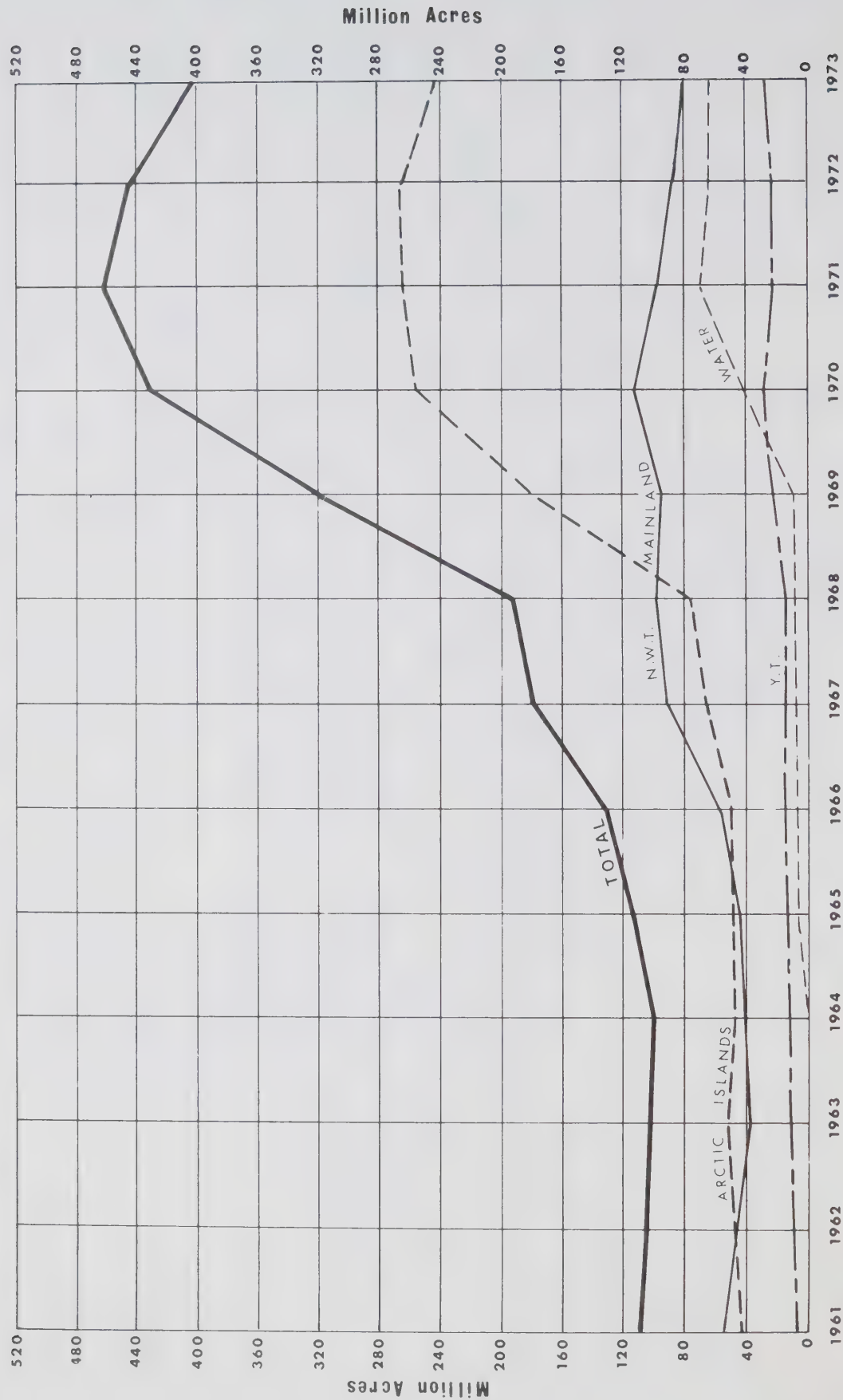


Fig. 2
YUKON TERRITORY - NORTHWEST TERRITORIES
ACREAGE UNDER LEASE
BY YEAR

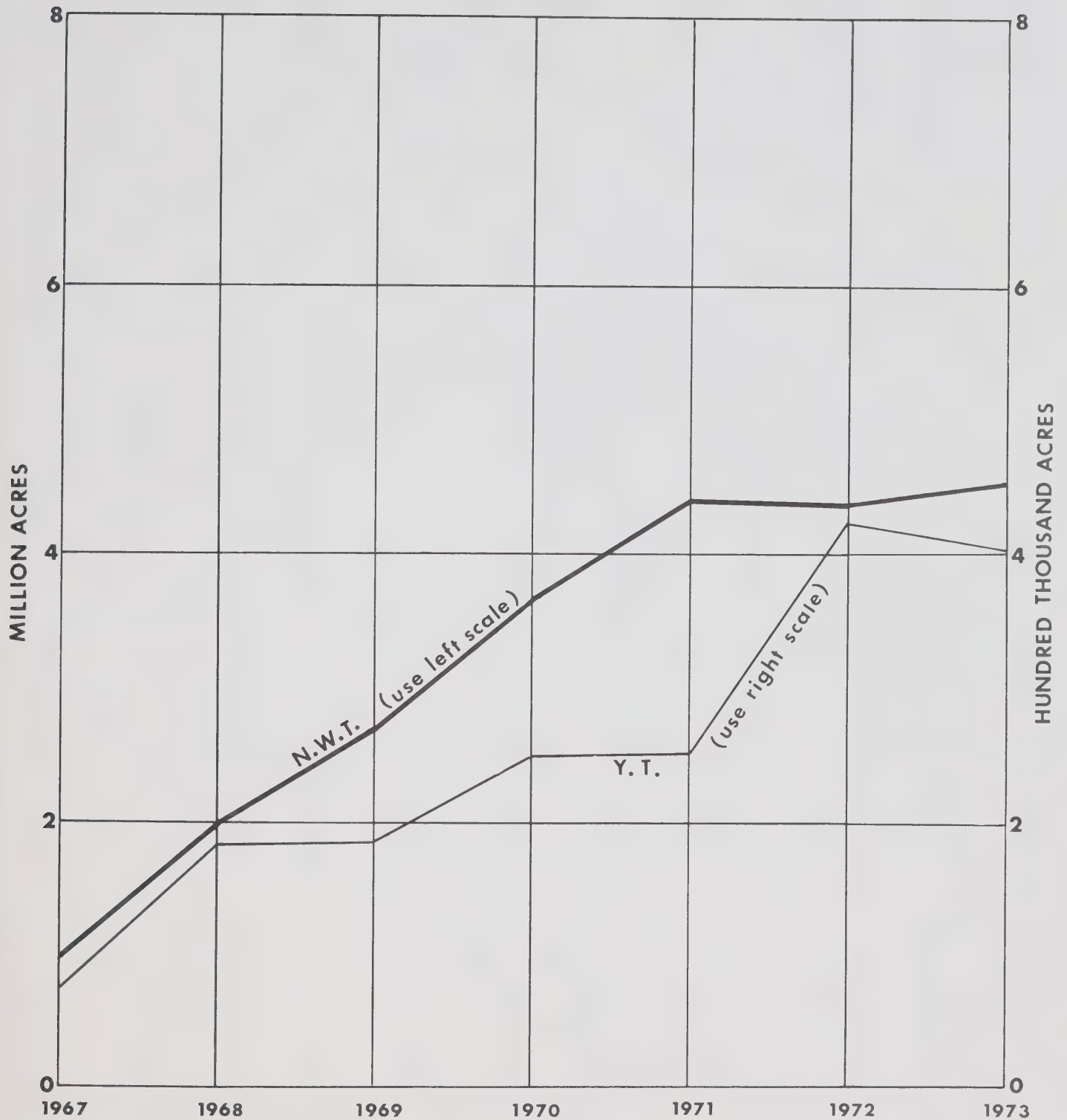




Fig.3

**PERMIT TERM AND WORK
REQUIREMENT ZONES**

NORTH OF 60°

-  \$ 2.65/AC.
-  \$ 2.70/AC.
-  \$ 2.90/AC.

Scale in miles

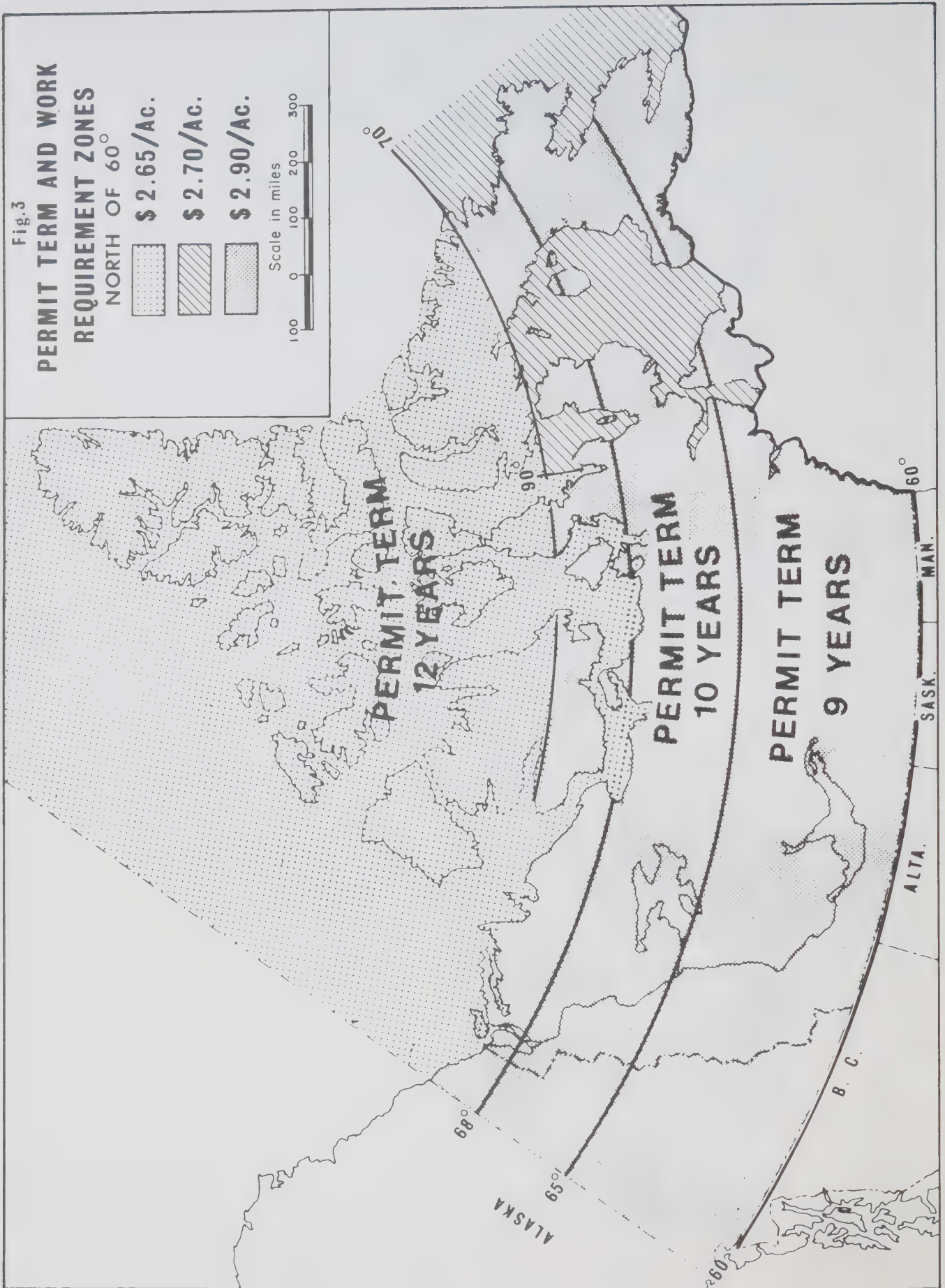


Fig. 4

YUKON TERRITORY - NORTHWEST TERRITORIES PERMIT TERMS AND DEPOSIT REQUIREMENTS — PER ACRE

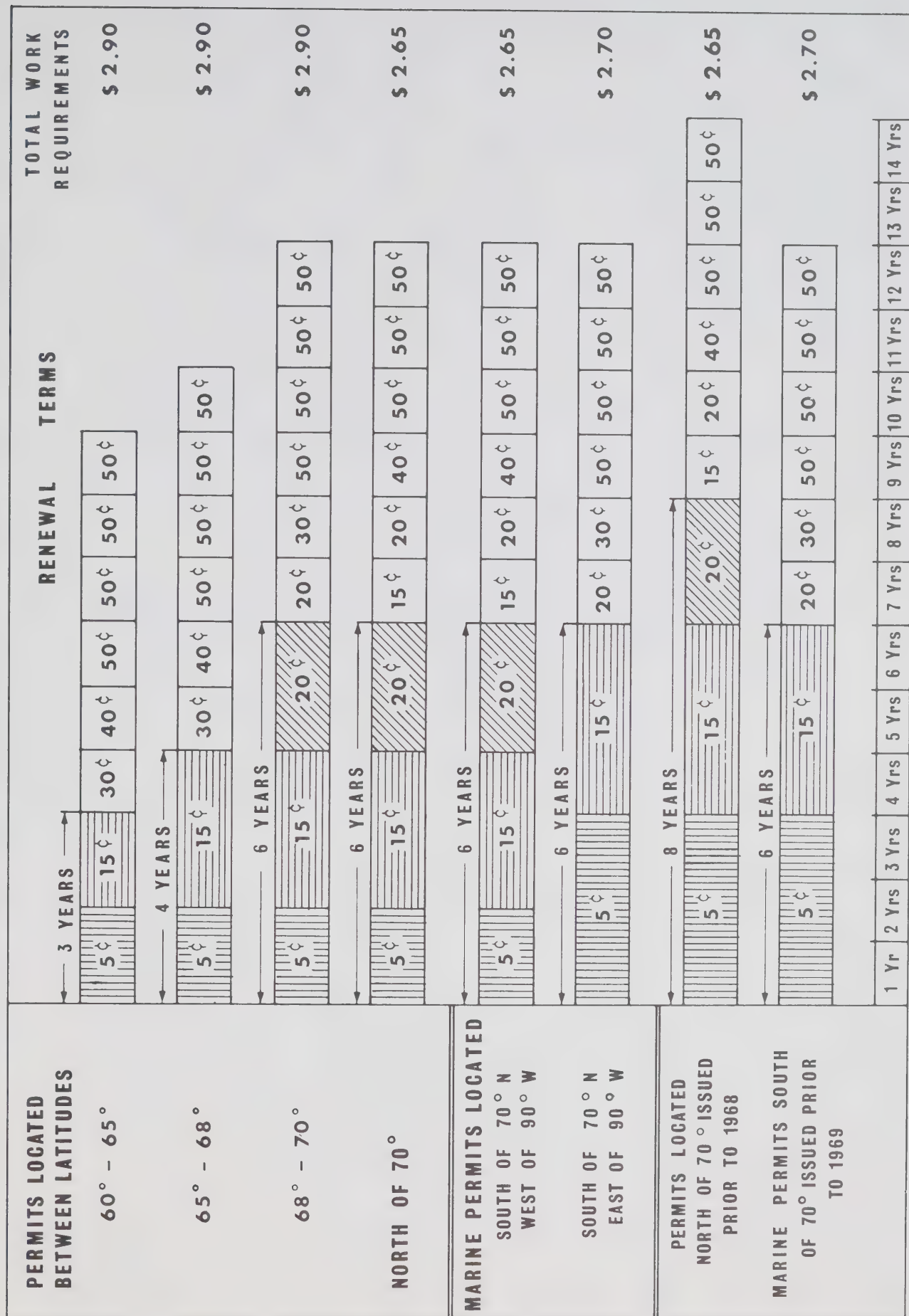


Fig. 5

ADDITIONAL ROYALTY RATES BY AREAS

PRIOR TO REVOCATION
OF LAND ORDER NO. 1-1961

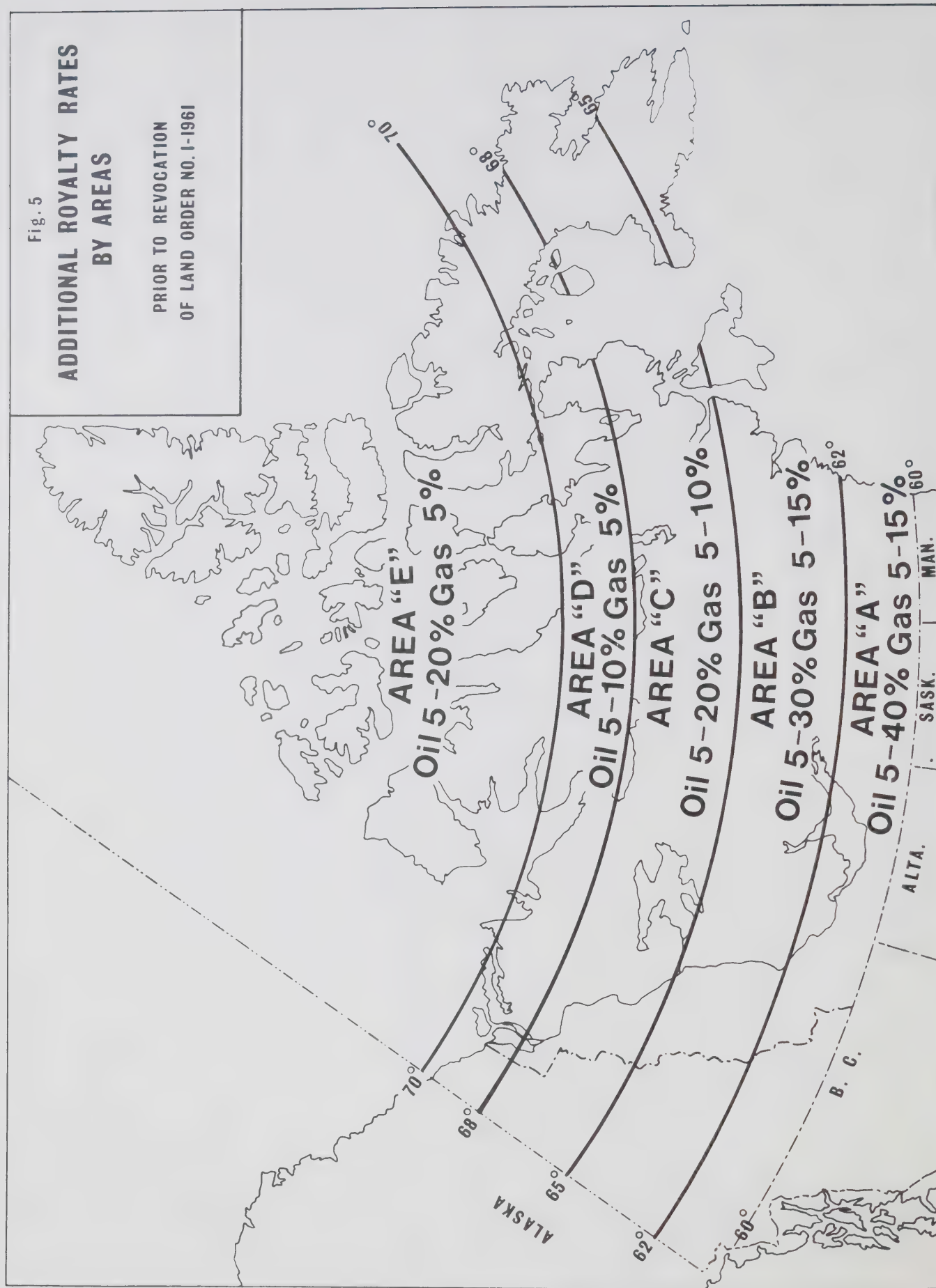


Fig. 6

FLOW DIAGRAM OF DISPOSAL OF OIL AND GAS RIGHTS

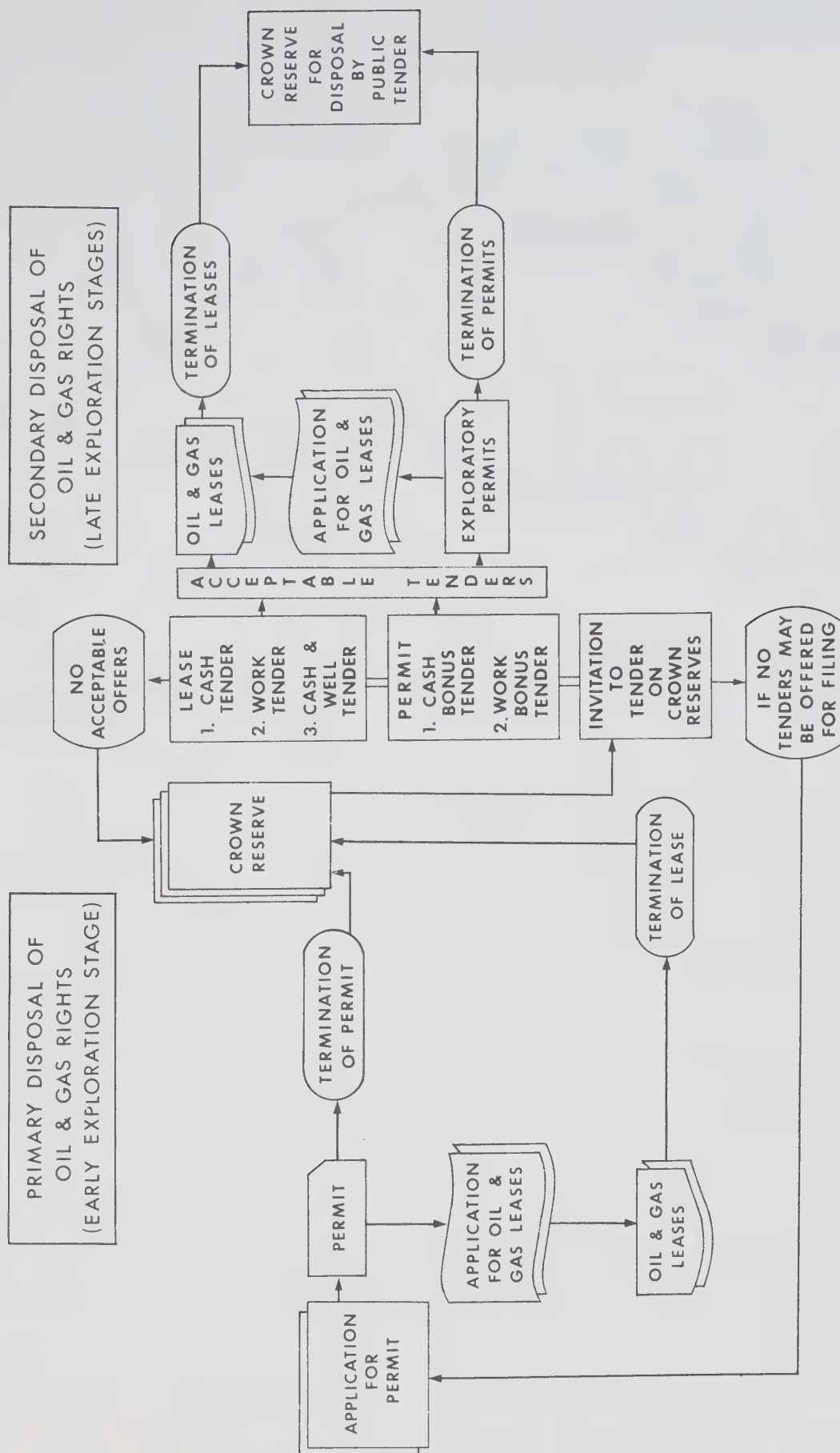


Figure 6 describes the flow of Canada Oil and Gas Lands under the Regulations and through the various disposal methods.

No amendments were made to the Regulations in 1973.

Exploration

Figures 7, 8, 9 and 10 graphically depict 1973 exploration activities North of 60. Expenditures on oil and gas exploration in the Northwest Territories and Yukon Territory exceeded \$250 million in 1973, an increase of \$12 million over the previous year. Exploratory and development drilling increased to \$173 million (up 23 per cent), while total geological and geophysical expenditures remain the same at approximately \$85 million. Expenditures for exploration drilling and seismic exploration exceeded similar work in every province and the combined Atlantic and Pacific offshore areas.

Figure No. 7 indicates that expenditures increased by 32 per cent in 1972 and by five per cent in 1973. Indications in early 1974 are that expenditures will remain the same as in 1973. By 1975, expenditures related to oil and gas activities should reach \$300 million per year if leases and permits are issued for areas under application. With the advent of development drilling in the Delta and possible construction of the Mackenzie Valley gas pipeline, expenditures in the late 70's may exceed \$1 billion a year.

Seismic crew months, depicted in Figure 8, are an excellent barometer of the magnitude of the drilling activity for the next year. In 1973, oil companies conducted 158 crew months of seismic work (see Table No. 3) in land and marine areas. This would indicate a significant decrease in drilling activities in 1974.

Figures 9 and 10 illustrate the number of wells drilled and the total depth drilled for each of the past 10 years. Note that footage increased by six times the 1968 total. This is also reflected in the expenditures increase for drilling in that there has been a 16-fold increase in drilling expenditures during the same interval. The large increase in drilling expenditures is attributed to the high cost of drilling wells on the Arctic Islands and Mackenzie Delta, and that one-half of the wells drilled was in the frontier areas.

Operations

Significant filing applications were being received for permits. Industry interest was centred on Victoria Island, Davis Strait area, and along the periphery of the polar ice. Applications for filing will be processed after the new Canada Oil and Gas Land Regulations are amended and promulgated.

Permits were surrendered or cancelled along the periphery of many basins on the Mainland and Arctic Islands. Significant numbers of permits were also surrendered in the Yukon and along the eastern periphery of the Mackenzie Valley Basin. Leases were surrendered in the southern Northwest Territories.

Surface geological and photogeological surveys by the Industry decreased by about 50 per cent in 1973, while seismic crew months decreased by approximately 30 per cent. A total of 158 crew months was reported, including 20 marine seismic

programs in the Mackenzie Delta, in the Beaufort Sea and the Baffin Bay — Davis Strait areas.

Seismic activity was general over many of the geological basins in the north. Detailed seismic work was carried out by Imperial Oil Enterprises, Gulf Oil Canada Limited, Shell Oil Canada and other along the Arctic Coastal Plain and in the Mackenzie Delta-Tuk areas. Five reflection seismic participation programs were initiated or continued in the Delta during the current season. In the Arctic Islands, major seismic programs were continued by Elf Oil Canada on Banks and Prince Patrick Island, while Panarctic Oils Ltd. and Sunoco Company, utilizing approximately 10 seismic crews, continued large scale reflection seismic programs over most of the Arctic Islands.

Marine seismic operations encountered severe ice conditions in the Arctic Islands and most marine seismic programs had to be reduced. One seismic survey was undertaken in the Sverdrup Basin area, and other were concentrated in the Lancaster Sound and Davis Strait areas. A considerable amount of marine seismic work was carried out in the Delta — Beaufort Sea and adjacent marine areas.

Drilling operations were concentrated in four areas: Eagle Plain in the Yukon Territory, the Mackenzie Delta — Tuk areas, Peel Plateau and the Arctic Islands, specifically in the Sverdrup Basin.

The first well on a man-made island in Canada was drilled by Imperial Oil in the Beaufort Sea during the current year. The well was abandoned at a depth of 8,883 feet when abnormally high formation pressures were encountered. At least two more wells will be drilled by Imperial Oil from man-made islands during the 1974 season.

Approvals in principle were given to two proposals for drilling from floating vessels in offshore locations in the Beaufort Sea. The companies will now proceed with design and construction of the offshore drilling units. Two more drilling proposals are being evaluated by drilling engineers and land use officials.

Gas discoveries were made in the Mackenzie Delta by Gulf Oil at Reindeer F-36; Titatik K-26; Ya Ya P-53; by Imperial at Taglu F-43; by Shell at Shell Kugpik O-13 and Niglintgak H-30. The Shell Kugpik O-13 well is also an oil discovery. Pacific discovered gas in their Tathlina N-18 well in the southern Territories. In the Arctic Islands, Panarctic Oils discovered gas in their Hecla I-69 and Thor H-28 wells and Dome in its Wallis K-62 well.

Through the Polar Gas Project, Panarctic Oils Limited continued feasibility studies on the gas pipelines from the Arctic Islands to the mainland. Two possible routes were proposed by Panarctic Oils Ltd. Both would cross Barrow Strait, one to proceed south along the west side of Hudson Bay, and the other along the east side of Hudson Bay. Detailed reconnaissances of both routes was made during the past year.

Large scale environmental and ecological studies were carried out by Gas Arctic Systems along the Mackenzie Valley corridor. The application to construct the pipeline was made in early 1974.

Table No. 3 1973 Exploration Survey Statistics

Area	Land Seismic			Marine Seismic		
	Geol. Crew Months	Crew Months	Line Miles	Crew Months	Line Miles	
Yukon	3	10.0	611	—	—	
N.W.T. — Mainland	9	25.0	1,152	—	18	
Mackenzie Delta	—	42.0	3,473	—	—	
Beaufort Sea	—	4.0	470	4.0	4,603	
Arctic Islands	37	58.0	5,551	—	—	
Offshore Arctic Islands	—	—	—	5	5,006	
Baffin Bay-Davis Strait	1	—	—	10	11,075	
Total	50	139	11,257	19	20,702	
<u>Structure Test Holes</u>						
Arctic Islands	No. Drilled 13			Footage Drilled 17,797		
				Crew Months 4		

Fig. 7

OIL & GAS EXPLORATION EXPENDITURES

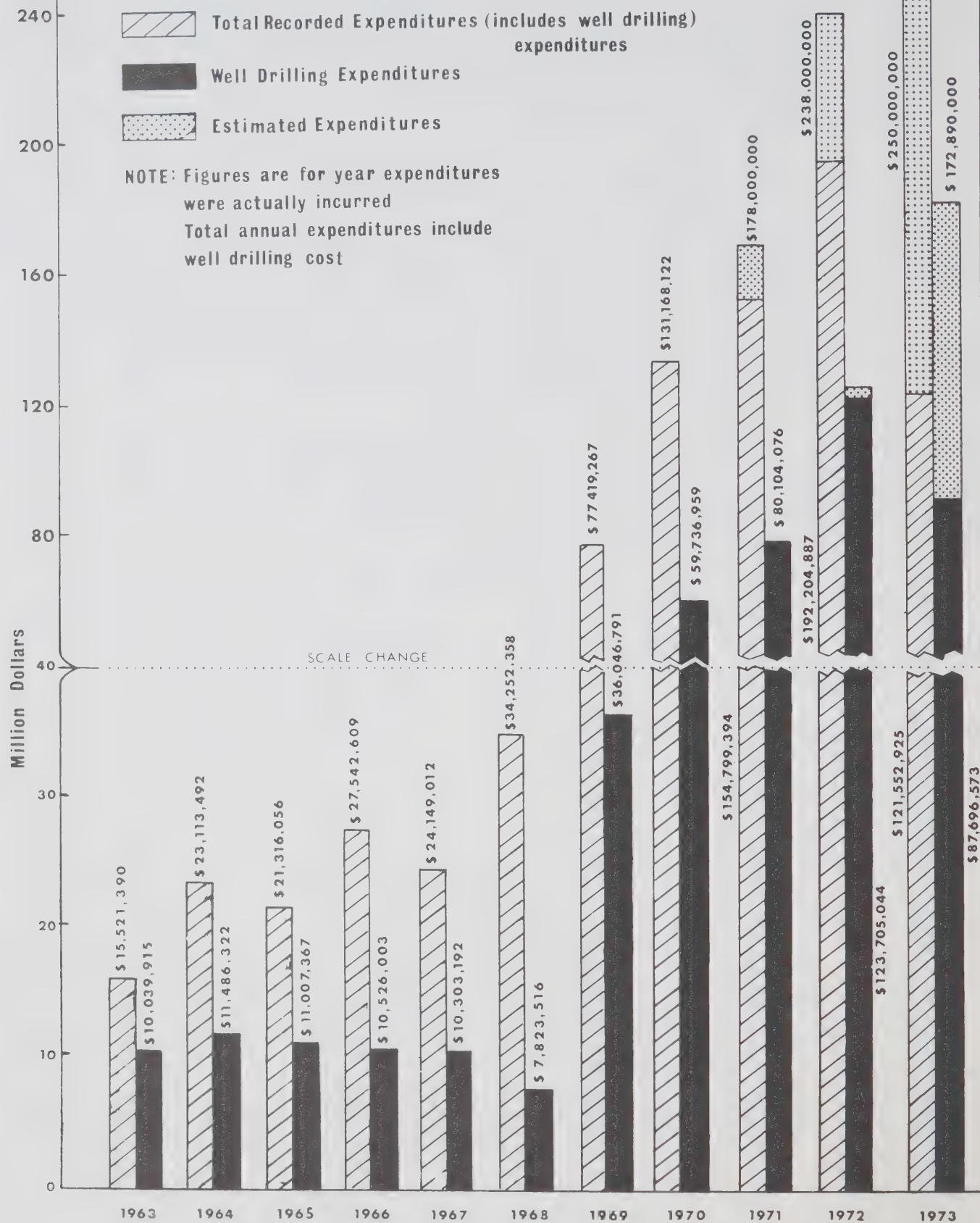


Fig. 8

EXPLORATION ACTIVITY

YUKON TERRITORY AND NORTHWEST TERRITORIES

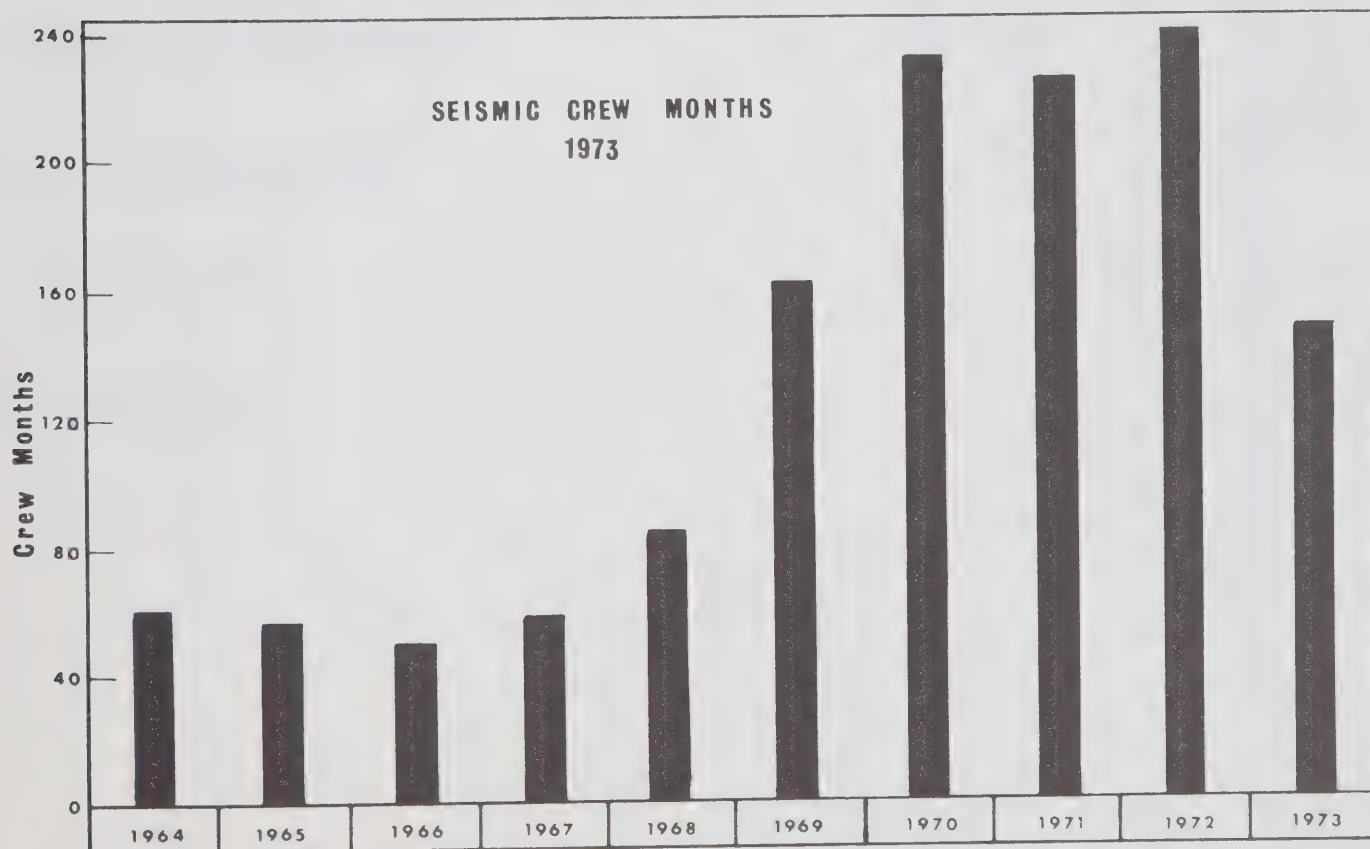
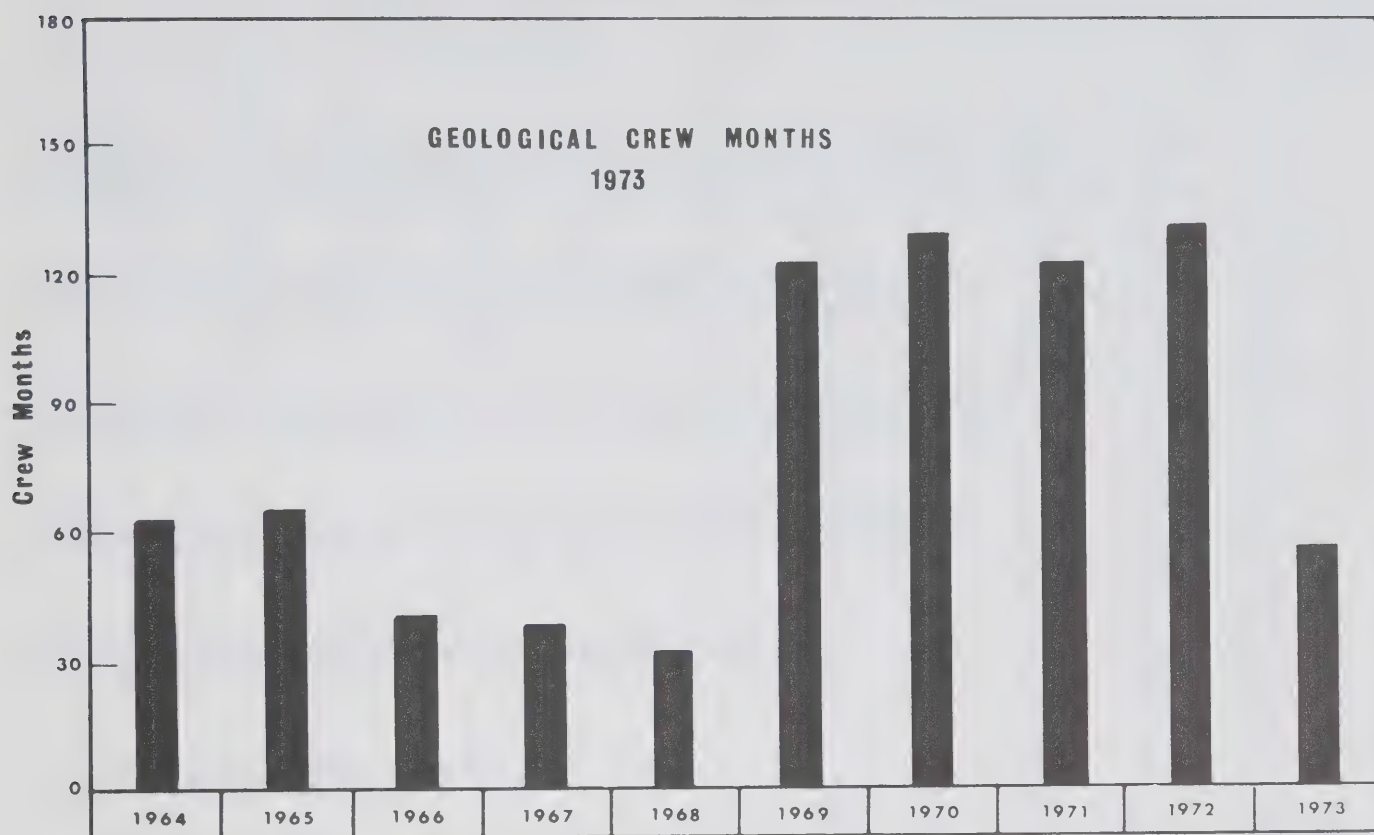


Fig. 9

WELLS DRILLED

YUKON TERRITORY - NORTHWEST TERRITORIES
Number of Wells Drilled to end 1973, 734

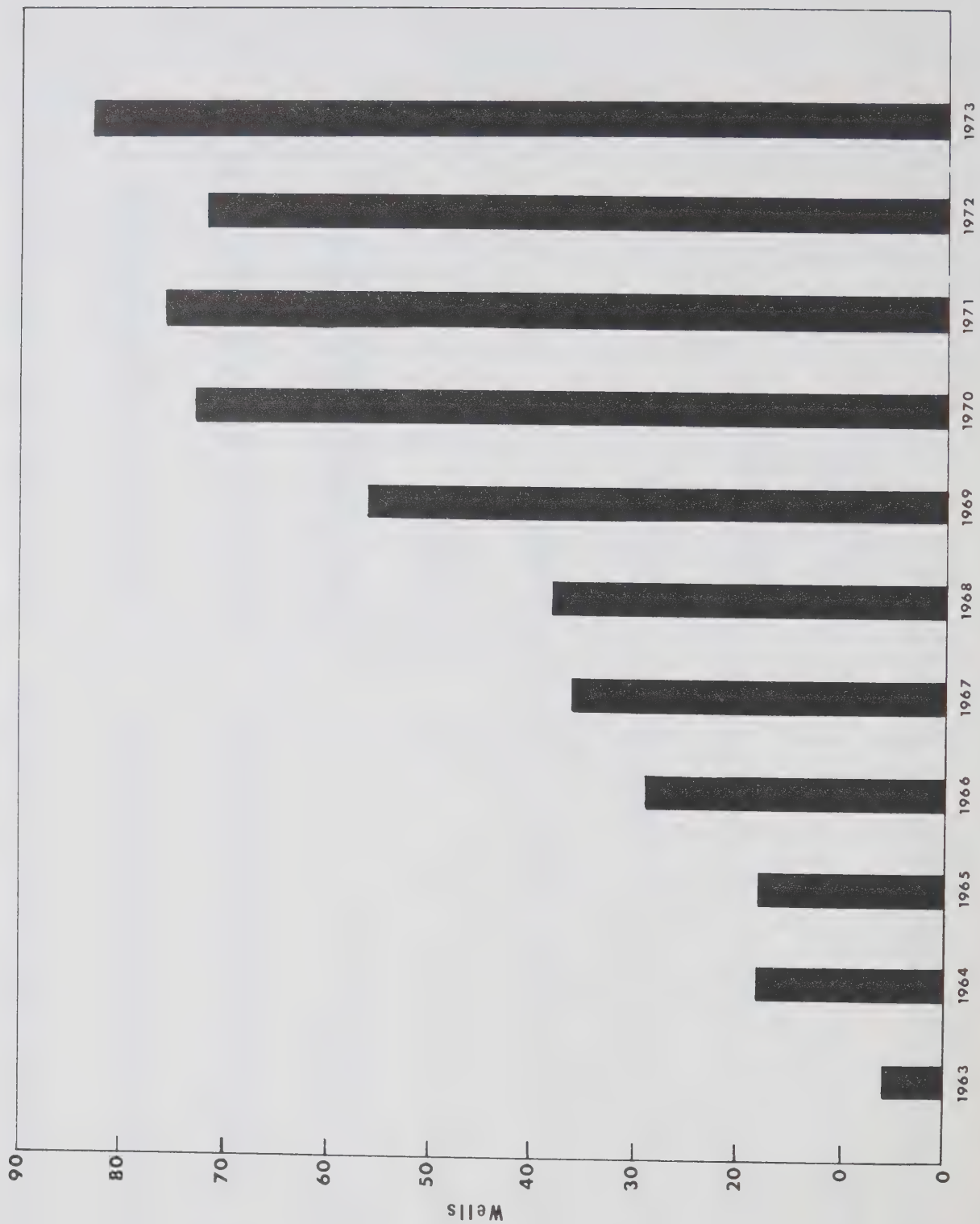


Fig.10

DEPTH DRILLED

YUKON TERRITORY AND NORTHWEST TERRITORIES

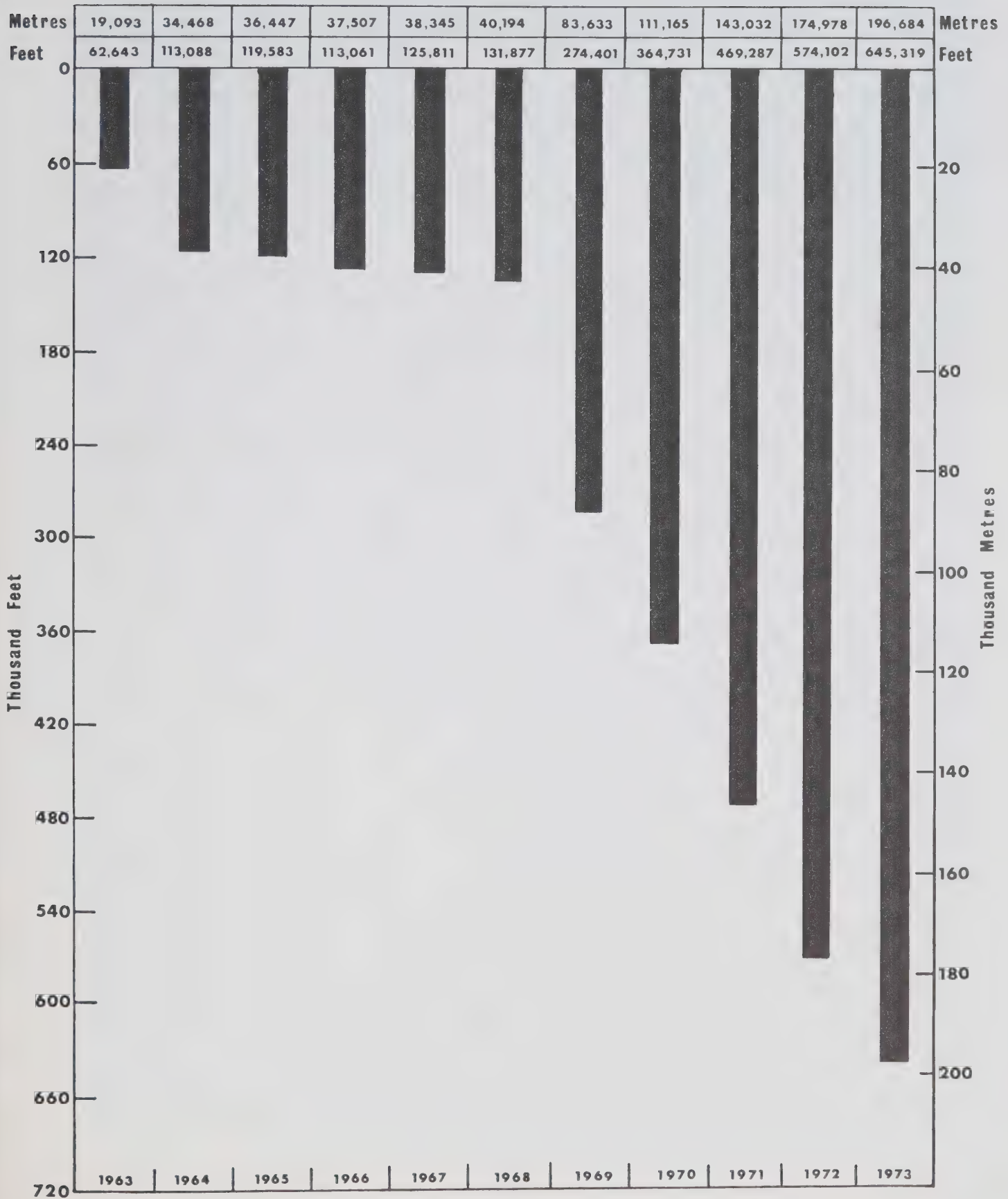




Photo No. 1 Gulf-Mobil Ya-Ya P-53 Gas Discovery Well in the Mackenzie Delta



Photo No. 2 Seismic operations on Richards Island in the Mackenzie Delta

Table 4 Production of Crude Oil and Natural Gas by Volume and Value 1950-1973

Year	Northwest Territories				Yukon Territory		Total
	Crude Oil		Natural Gas		Natural Gas		
	Volume (Bbls)	Value (\$000's)	Volume (Mcf)	Value (\$000's)	Volume (Mcf)	Value (\$000's)	Value (\$000's)
1950	183,591	325	33,335	13	—	—	338
1951	217,818	316	19,333	8	—	—	324
1952	259,418	312	24,847	10	—	—	322
1953	316,689	256	26,109	10	—	—	266
1954	369,887	384	29,085	10	—	—	394
1955	404,219	1,040	18,670	6	—	—	1,046
1956	449,409	940	21,210	7	—	—	947
1957	382,701	253	19,243	6	—	—	259
1958	457,086	839	24,100	8	—	—	847
1959	430,319	765	67,189	23	—	—	788
1960	468,545	644	39,785	12	—	—	656
1961	516,979	714	41,678	17	—	—	731
1962	566,168	624	56,707	24	—	—	648
1963	630,465	768	51,478	21	—	—	789
1964	574,125	564	34,341	14	—	—	578
1965	660,770	742	43,068	18	—	—	760
1966	741,476	853	46,238	20	—	—	873
1967	684,179	533	40,589	17	—	—	550
1968	753,592	909	42,602	18	—	—	927
1969	801,341	556	43,723	18	—	—	574
1970	846,003	1,142	81,939	35	—	—	1,177
1971	939,151	1,202	299,204	117	869,102*	90*	1,409
1972	890,067	1,058	12,033,308	1,326	3,458,000*	338*	2,722
1973	962,733	2,240	37,359,567	3,387	3,402,449*	381*	6,008
Total	13,506,731	17,979	50,497,348	5,145	7,729,551	809	23,933

*Seven per cent of total field production.

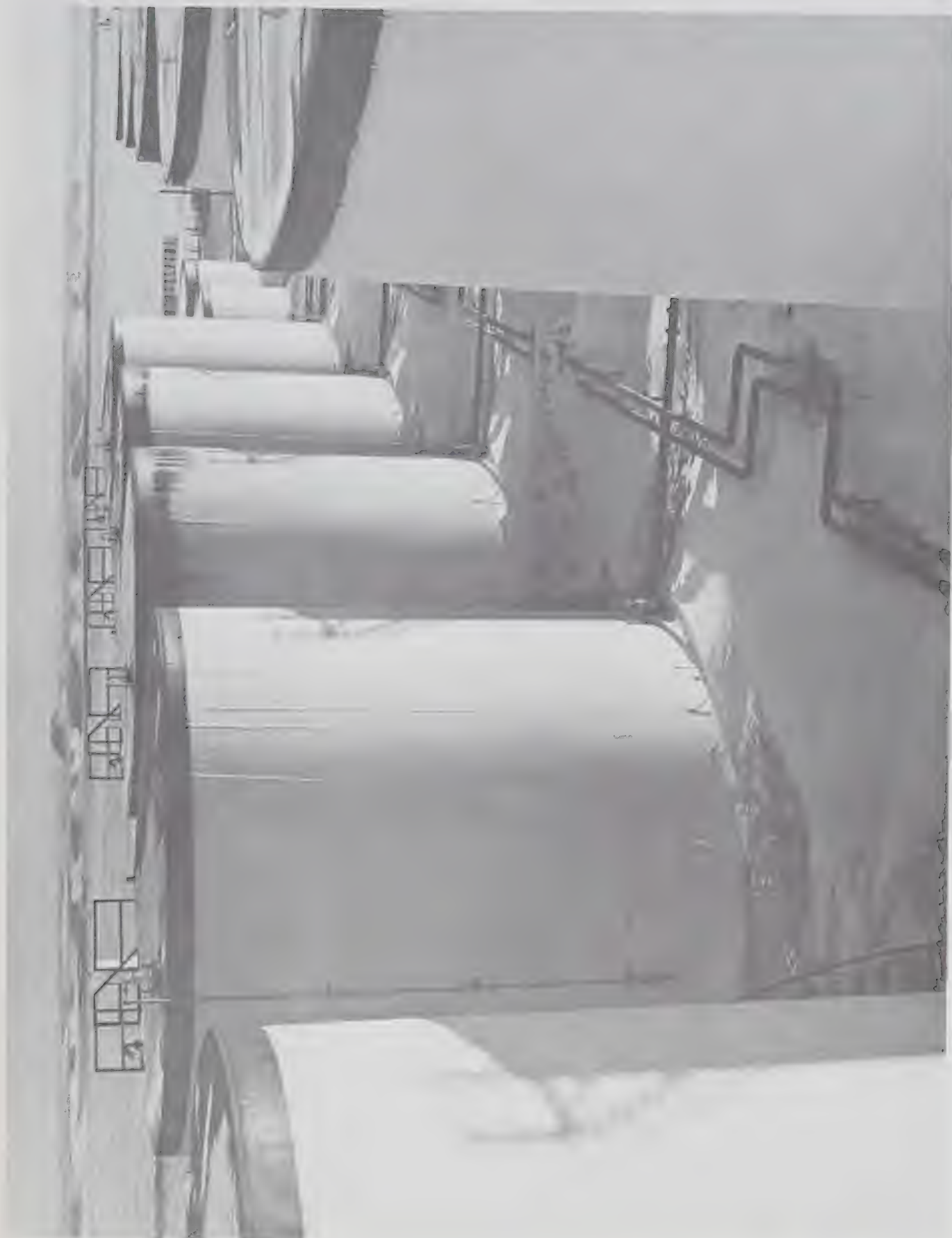


Photo No. 3 Gulf Oil's Swimming Point storage depot in the Mackenzie Delta



Photo No. 4 Additions to the N.T.C.L. fleet arriving at Tuk

Drilling and Conservation Activities

Land Drilling Activities

Figures 9 and 10 graphically illustrate the drilling activities North of 60 in the calendar year 1973. The number of wells drilled increased from 71 in 1972 to 83 in 1973, while the total footage drilled increased by 12 per cent over that of 1972.

Approximately 92 per cent of the footage drilled in 1973 was exploratory drilling, with eight of the wells reporting discoveries of oil and gas. Six development wells were drilled during 1973, all being gas development wells. Of these five were suspended: two in the Arctic Islands, one in the extreme southern part of the N.W.T. and two in the Mackenzie Delta. The other was completed as a gas producer in the Pointed Mountain Gas Field.

Drilling operations and production facilities North of 60 were regularly inspected by Oil and Gas Conservation Engineers and technicians of the Oil and Minerals Division to ensure that safe operating practices were being followed, that the objectives of conservation of oil and gas resources were being met and that contingency plans for the protection of the environment from blowouts and oil spills were adequate.

Close liaison was maintained between the Oil and Minerals Division and the oil and gas industry to ensure that drilling and completion activities were conducted safely and in accordance with modern advanced technology. In 1973 two meetings were held in Calgary between the Oil and Minerals Division and the oil and gas industry. The first meeting was organized to stress the importance of advanced training for supervisory drilling personnel to ensure proper well-control while drilling and to prevent any accidental waste of resources, injury to personnel or damage to equipment. The second meeting dealt with the problem of permafrost and resulted in a beneficial exchange of technical opinions and data on methods of preventing disturbance to the delicate subsurface thermal regime of the North.

Offshore Drilling Activities

In 1973 proposals for two offshore drilling programs in the Beaufort Sea, utilizing floating ice strengthened vessels, were assessed and granted Approvals in Principle to enable sponsors to make contractual commitments for the drilling systems. Actual offshore drilling operations will not commence before 1976. Three other offshore drilling proposals were co-ordinated or received during the year — two were additional proposals for drilling in the Beaufort Sea and the other for drilling in the Lancaster Sound area.

Imperial Oil Limited constructed an island (Immerk) in the shallow waters of the southern Beaufort Sea. Using a dredge barge, it was built from bottom sediments. An exploratory well was successfully drilled and abandoned from this island during 1973. Approval was granted and construction was completed on a second island (Adgo) in the same general area, with drilling operations being initiated during December 1973. Island construction techniques have now been developed to the extent that considerable island drilling activity is anticipated in the future.

A novel drilling system was assessed for Panarctic Oils Limited and granted Approval in Principle during the year. The system

incorporates a conventional land drilling rig in conjunction with some offshore equipment, and includes a sea floor blow-out preventor and a marine riser. The drilling rig will be installed on a specially designed ice platform to be constructed by freezing layers of sea water on the natural ice surface. The proposed drilling site is in the Hecla area where sufficient data have been obtained on geology to ensure the safety of the operation.

Production Activities

Three gas wells, Pan Am Pointed Mountain K-45, P-53 and O-46 (in grid area 60-30-123-45) produced at a combined gross average rate of 101.6 MMcf/D plus 395.4 BWPD for a yearly total of 37.090 Bcf and 144,331 bbls. of water. A fourth well, Amoco Pointed Mountain F-38-60-30-123-45, has been completed and awaits construction of a gathering pipeline to the Pointed Mountain Gas Plant. A fifth well, Amoco Pointed Mountain A-55-60-30-123-45, was commenced in early 1974.

The Beaver River Gas Field straddles the Yukon — B.C. border with one well, Pan Am Beaver River Y.T. G-01-60-10-124-15 in the Yukon portion of the field. No production was taken from the Pan Am Beaver River Y.T. G-01 well during 1973. However, under a royalty — sharing unitized pool agreement between the Government of B.C. and the Government of Canada, seven per cent of the total field production or 3,402 Bcf was assigned to the Yukon portion of the field during the year.

The Norman Wells Oil Field, lying in the west central part of the N.W.T. had 59 oil wells capable of production, 43 producing regularly. Total gross field production during 1973 averaged 2,802 BOPD, plus 4.74 MMcf/D of gas, for a yearly total of 1,022,722 bbls. of oil and 1.730 Bcf of gas. The water injection plant of the pressure maintenance scheme injected fresh water at an average rate of 1,504 BWPD, for a yearly total of 549,314 bbls. of water injected.

Participation and Research Projects

Approximately 25 participation and research-type projects were initiated or continued during 1973. This is in addition to Arctic Petroleum Operators' Association programs. Expenditures incurred for these projects qualify for work credits and when approved can be applied to permits in approved designated areas. Major programs in these categories in 1973 were:

Geophysical Surveys

1. *Eureka Exploration Limited* the company carried out three large reconnaissance marine seismic programs. One encompassed the sedimentary area in the Davis Strait Baffin Bay area; the second marine program was in the Beaufort Sea. The third program was a combined land and water seismic survey shot over the ice in the Delta.
2. *Delta "5" Group* — a land seismic survey, operated by Canadian Superior on behalf of four other oil companies, carried out a 500-mile program over the ice in the Delta.
3. *ARCO* — a land seismic survey, operated by ARCO on behalf of 37 participants, carried out in the Delta area over the ice.



Photo No. 5 MV Frank Broderick in floating drydock at Tuktoyaktuk

4. *Geophysical Services Incorporated* — the company carried out three large reconnaissance marine seismic surveys. One was a continuation of the Baffin Bay — Davis Strait area; the other two, in association with Geophoto Ltd., were in the Sverdrup Basin and Beaufort Sea.
5. *Phoenix Ventures Limited* — carried out two large land seismic programs along the Arctic Coast — Delta area and Sverdrup Basin. Much of the latter program was carried out over ice during the winter months.
6. *Sigma Exploration Limited* — completed their Colville Lake shooting and in 1973 carried out a large over-the-ice program in the Sverdrup Basin. This latter program consisted of a single line joining the major oil and gas discoveries in the Sverdrup Basin. This will provide information on a regional basis in the assessment of the geological framework in the Sverdrup Basin.
7. *Overland Exploration Services Ltd.* completed a large reconnaissance gravity program in the Liard area of the Yukon and Northwest Territories.
8. *Photogravity Services Ltd.* — completed a comprehensive gravity survey from Lat. 60° along the Mackenzie Valley to the Delta and along the Arctic Coast to the Alaska border.

Geological Surveys

Klovan completed the third summer of stratigraphic surveys on Banks Island.

Robertson Research Ltd. are carrying out a paleontological and palynological determination on samples from selected wells in the Delta and Arctic Islands.

V. Zay Smith Associates Ltd. completed large structural and stratigraphic mapping programs along the Mackenzie Valley to the Arctic Coast.

Arctic Gas Pipeline Group to Carry out Research

A group composed of Panarctic Oils Ltd., TransCanada Pipelines Limited, Canadian Pacific Investments Limited and Tenneco Oil and Minerals Ltd., announced an agreement for research investigations and the planning of a natural gas pipeline from the Canadian Arctic Islands. The undertaking will be known as the "Polar Gas Project". TransCanada Pipelines will manage the project and the expertise will be provided by the staff of the participating companies. The four companies bring to the group a wealth of knowledge and experience in gas pipeline transmission, in transportation in general and in Arctic operations. The research, engineering and planning started with the preliminary route reconnaissance survey conducted last year under the direction of Panarctic. At that time, two routes were surveyed, both down the Boothia Peninsula, one passing to the west of Hudson Bay and the other to the east.

The work carried out in 1973 involved environmental studies conducted by consultants, along with engineering work such as ice investigations, aerial photography, on-the-ground surveys, soil samplings, permafrost evaluation and mapping. Special efforts were devoted to marine surveys of Arctic Islands water

crossings, including studies of necessary equipment required to construct such installations.

Arctic Petroleum Operators' Association Spent \$1.5 million in 1973

The Arctic Petroleum Operators' Association (APOA) spent \$1.5 million in its 1973 programs. This was mainly on activities directly related to far north operations.

APOA continues to have representation on the Advisory Committee for the Arctic Land Use research program, and has supported projects conducted in the Mackenzie Delta area by the University of Alberta and other Canadian universities.

In addition, the APOA supported studies undertaken by the University of Alberta of both natural and artificially assisted rehabilitation of terrain subject to degradation by the import of vehicles.

Under the International Biological Program, APOA was also involved in the Devon Island project. This consisted of a multidisciplinary study of the high Arctic tundra eco-system.

The Association undertook the preparation of an Operators' Guide Booklet distribution to its members and to government personnel. The booklet is available to any other interested parties at a cost of \$25 a copy. In addition, as a gesture of international co-operation, the drilling sub-committee of APOA will make available copies of the booklet to their counterparts in the Canadian-Soviet mixed commission for exchange of general technology in oil and gas field development.

In 1973 an ice, weather, sea state, and data gathering and processing program was initiated. The objective of the program is to predict ice movements and coverage to gather information on micro-weather, on sea state and to develop techniques to accurately predict ice position relative to rig location in the Beaufort Sea. Total cost of this program is estimated at \$550,000.

Two-Year Environmental Study Delays Beaufort Sea Drilling

The Department indicated that offshore drilling in the Beaufort Sea will not be allowed to start before the summer of 1976, so that at least two full years of environmental studies can be completed by industry and government.

The oil industry has tentatively agreed to fund up to \$4.1 million for the "priority" environmental studies that must be done during this two-year period before any actual drilling can begin.

The Northern Affairs Minister indicated that two of the Beaufort Sea interests, Dome Petroleum Ltd. of Calgary and Hunt International Petroleum of Calgary, have been authorized to start construction of drilling systems for later use in the Beaufort Sea.



Photo No. 6 Seismic operations on sea ice off Ellef Ringnes Island

Exploration-Items of Interest

Oil and Gas Drilling and Production Regulations

A joint project was initiated by the Department of Indian and Northern Affairs and the Department of Energy, Mines and Resources to up-date the Canada Oil and Gas Drilling and Production Regulations. Sections of the regulations pertaining to the drilling of both onshore and offshore wells have now been completed in draft form and at the end of 1973 preparations were being made to have these sections ready for review by industry.

The drafting of sections of the regulations pertaining to production, pipelines, processing plants and related facilities was initiated in late 1973. It is anticipated that the sections of the Canada Oil and Gas Drilling and Production Regulations pertaining to drilling will be promulgated in late 1974, and these sections pertaining to production, pipelines, processing plants and related facilities early in 1975.

Land Use Regulations

In June, 1970, amendments to the Territorial Lands Act were passed by Parliament, which permitted the implementation of Territorial Land Use Regulations. The Regulations were promulgated on November 4, 1971.

The Regulations provide authority for designating Land Management Zones in the Yukon Territory and Northwest Territories. Within these zones all land use operations, including resource exploration and development, require Land Use permits, which stipulate the measures to be followed by the operator to protect the terrain and ecosystems. Permit conditions are established on the recommendation of an inter-department and in inter-government Land Use Advisory Committee.

The Land Use Regulations are administered in the Northwest Territories by the Regional Director of Resources and his staff in Yellowknife and Fort Smith; in the Yukon Territory the Regulations are administered by the Regional Director of Resources and his staff in Whitehorse. Exploration programs carried out on all offshore areas contiguous to the Northwest Territories are monitored by the Regional Director of Resources in Yellowknife.

Canada — Denmark Conclude Continental Shelf Agreement

The Government of Canada and Denmark have concluded an agreement concerning the delimitation of the continental shelf between Greenland and Canada.

This is the first continental shelf agreement that Canada has concluded with a neighbour. Through this agreement, Canada and Denmark have agreed on a dividing line up to which either

party can extend its sovereign rights for the purpose of exploration and exploitation of the natural resources of the continental shelf between the Canadian Arctic Islands and Greenland. This is in accordance with the 1958 United Nations Convention on the Continental Shelf.

The dividing line, some 1,430 nautical miles in length, is the longest continental shelf delimitation in the world. It has been determined on the basis of the principle of equidistance, incorporating certain adjustments necessary to arrive at a mutually agreeable and equitable solution.

The agreement also provides for co-operation between Canada and Denmark in obtaining and improving hydrographic and geodetic knowledge necessary for more precise charting and mapping of the region covered by the agreement.

Canada Arctic Gas Study Estimated Delta Gas Reserves at 7tcf
Canadian Arctic Gas Study Ltd., on September 26, 1973, disclosed the results of their studies regarding natural gas reserves in the Mackenzie River Delta and Beaufort Sea areas. The studies were made by the engineering and geological consulting firms of J.C. Sproule and Associates Ltd. and DeGolyer and MacNaughton.

The firms independently estimated the potential gas reserves of the Delta area, including the shallow water areas of the Beaufort Sea, to be approximately 55 trillion cubic feet. The consultants further conclude that substantial but longer term potential reserves exist in the Beaufort Sea area beyond the shallow water area.

Of the 55 trillion cubic feet of potential gas reserves, the studies show that approximately seven trillion cubic feet of gas can be expected to be derived from fields now discovered. The consultants estimate that at the current rate of exploration drilling, substantial additional reserves will be established prior to the completion of the proposed Arctic Gas pipeline from the Delta area.

Canadian Arctic Gas had concluded that the Delta and Beaufort Sea gas, in combination with proven reserves of some 25 trillion cubic feet in the Prudhoe Bay area of Alaska, will provide sufficient natural gas supplies for the project. The pipeline will provide vitally needed natural gas for Canada and the United States.

Current Gas Contracts in the Mackenzie Delta

The largest natural gas purchase contract in Canadian history, in terms of both volume and dollar commitment, has been signed. The contract involves as gas suppliers Shell Canada



Photo No. 7 Imperial Oil's Taglu G-33 gas discovery well in the Delta



Photo No. 8 Desert truck and "Husky 8" special purpose vehicles used in the Mackinzie Delta

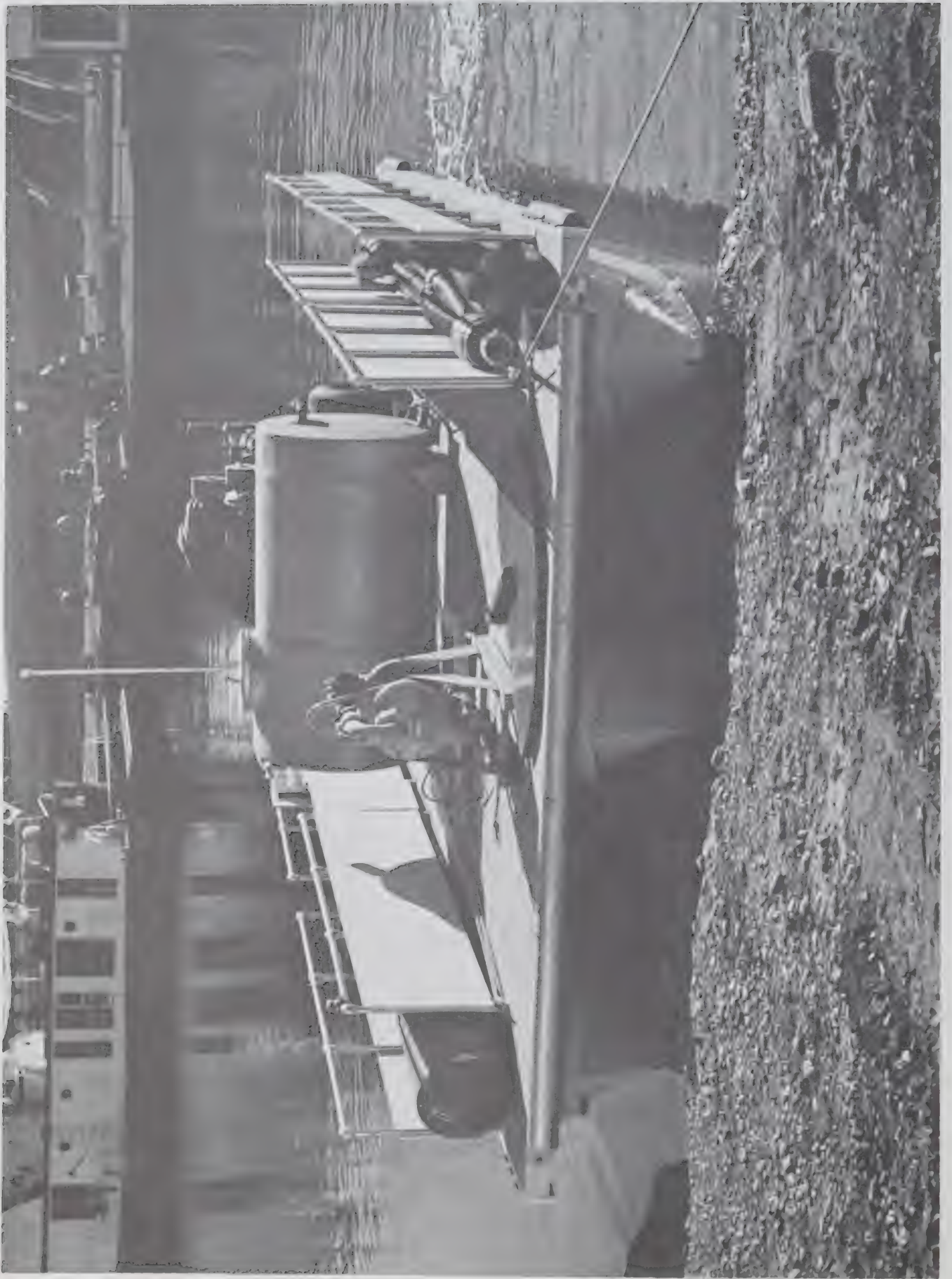
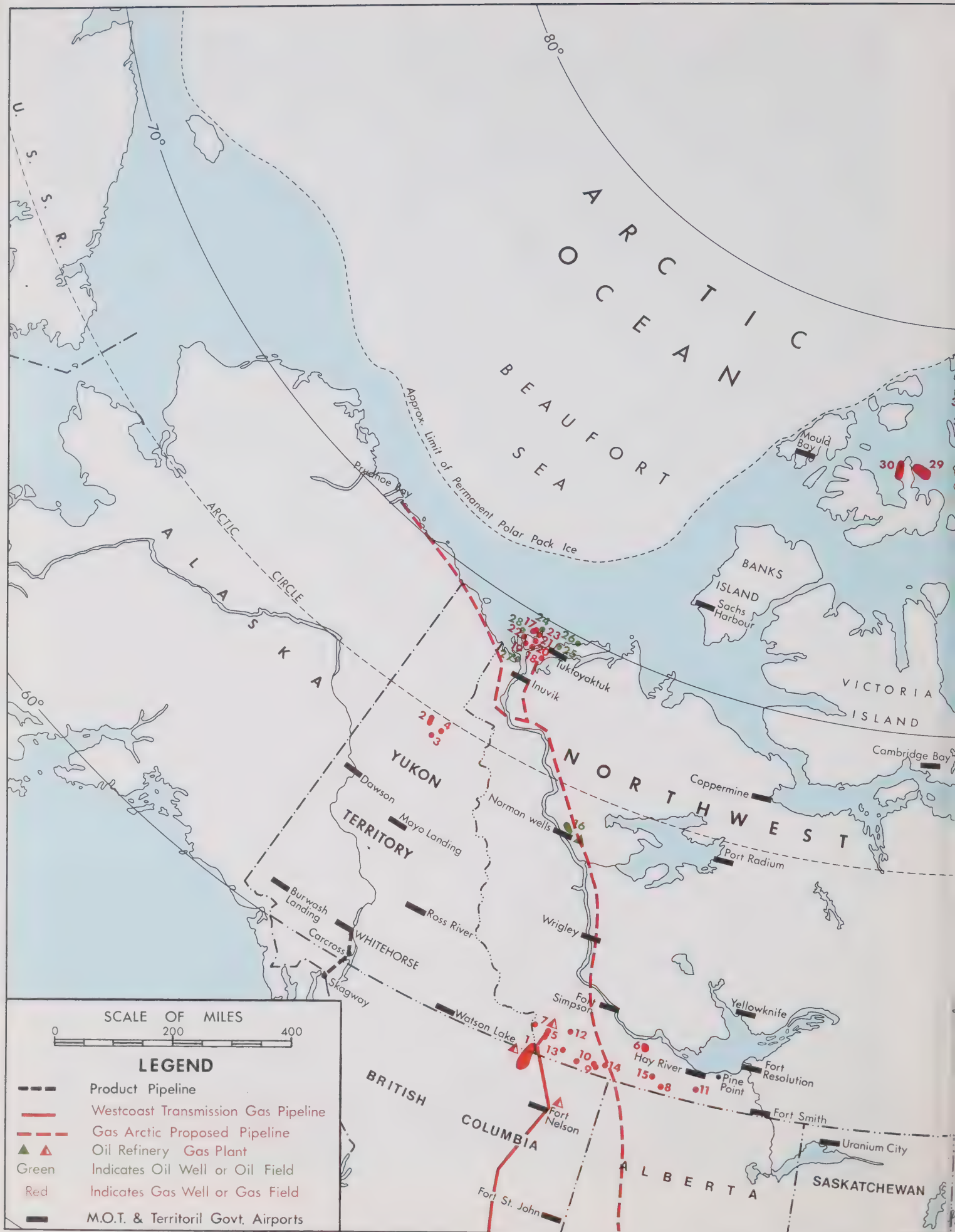


Photo No. 9 One of five pollution control equipment units located at various ports in the North
by Northern Transportation



Photo No. 10 M.V. Carino carrying out marine seismic survey in Belcher Channel



OIL AND GAS FIELDS AND DISCOVERIES

YUKON TERRITORY

- 1 Beaver River Gas Field
- 2 Chance Gas Field
- 3 Socony Mobil et al Blackie No.1
- 4 Socony Mobil et al Birch Y.T. B-34

NORTHWEST TERRITORIES

- 5 Pointed Mountain Gas Field
- 6 Rabbit Lake Gas Field
- 7 C.P.O.G. et al La Biche F-08
- 8 H.B. Cameron Hill A-05
- 9 S. Island River Gas Field
- 10 Home Signal Celibeta H-78
- 11 Shell H.B. Grumbler G-63
- 12 Sun Netla C-07
- 13 Texaco Bovie Lake J-72
- 14 Union Pan Am. Trainer Lake C-39
- 15 Pacific Amoco Tathlina N-18
- 16 Norman Wells Oil Field
- 17 Taglu Gas Field
- 18 Parsons Gas Field
- 19 Gulf Imperial Shell Titalik K-26
- 20 Gulf Imperial Shell Reindeer F-36
- 21 Gulf Mobil Ya Ya P-53
- 22 Shell Niglintgak H-30
- 23 Imperial I.O.E. Mallik L-38
- 24 Imperial Ivik J-26
- 25 I.O.E. Mayogiak J-17
- 26 I.O.E. Atkinson H-25
- 27 Shell Kugpik O-13
- 28 Imp. Adgo F-28

ARCTIC ISLANDS

- 29 Drake Point Gas Field
- 30 Hecla Gas Field
- 31 King Christian Gas Field
- 32 Panarctic Tenneco et al Kristoffer Bay B-06
- 33 Dome Arctic Ventures Wallis K-62
- 34 Thor Gas Field
- 35 Panarctic Romulus



Fig. 11

YUKON TERRITORY-NORTHWEST TERRITORIES

GROSS REVENUE-OIL & GAS
FROM
CASH BONUS BIDS, FEES, FORFEITURES
ROYALTIES RENTALS & SALE OF MAPS

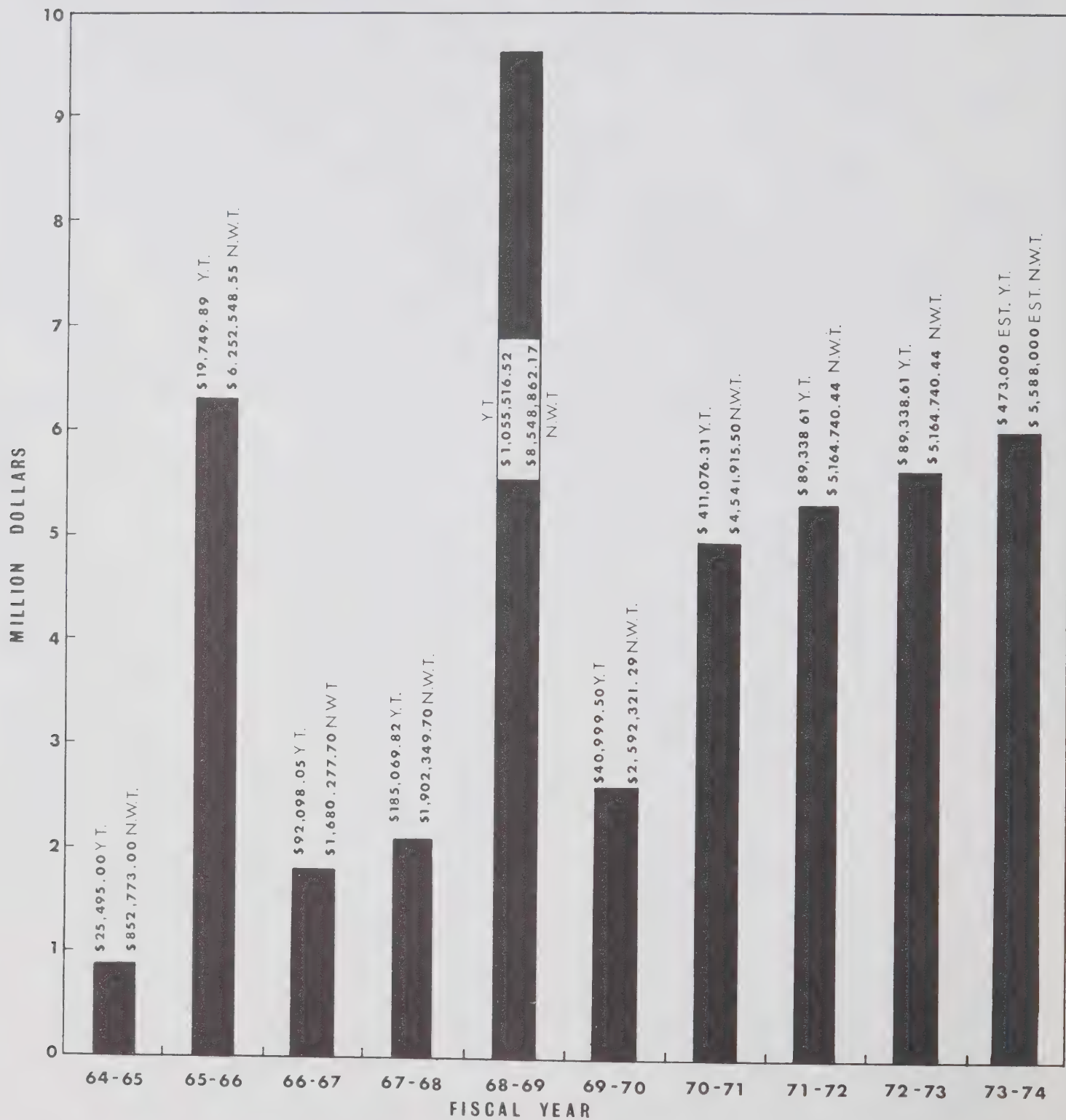


Fig. 12

YUKON TERRITORY - NORTHWEST TERRITORIES

GROSS REVENUE - OIL & GAS

FROM

CASH BONUS BIDS, FEES, FORFEITURES

ROYALTIES, RENTALS & SALE OF MAPS

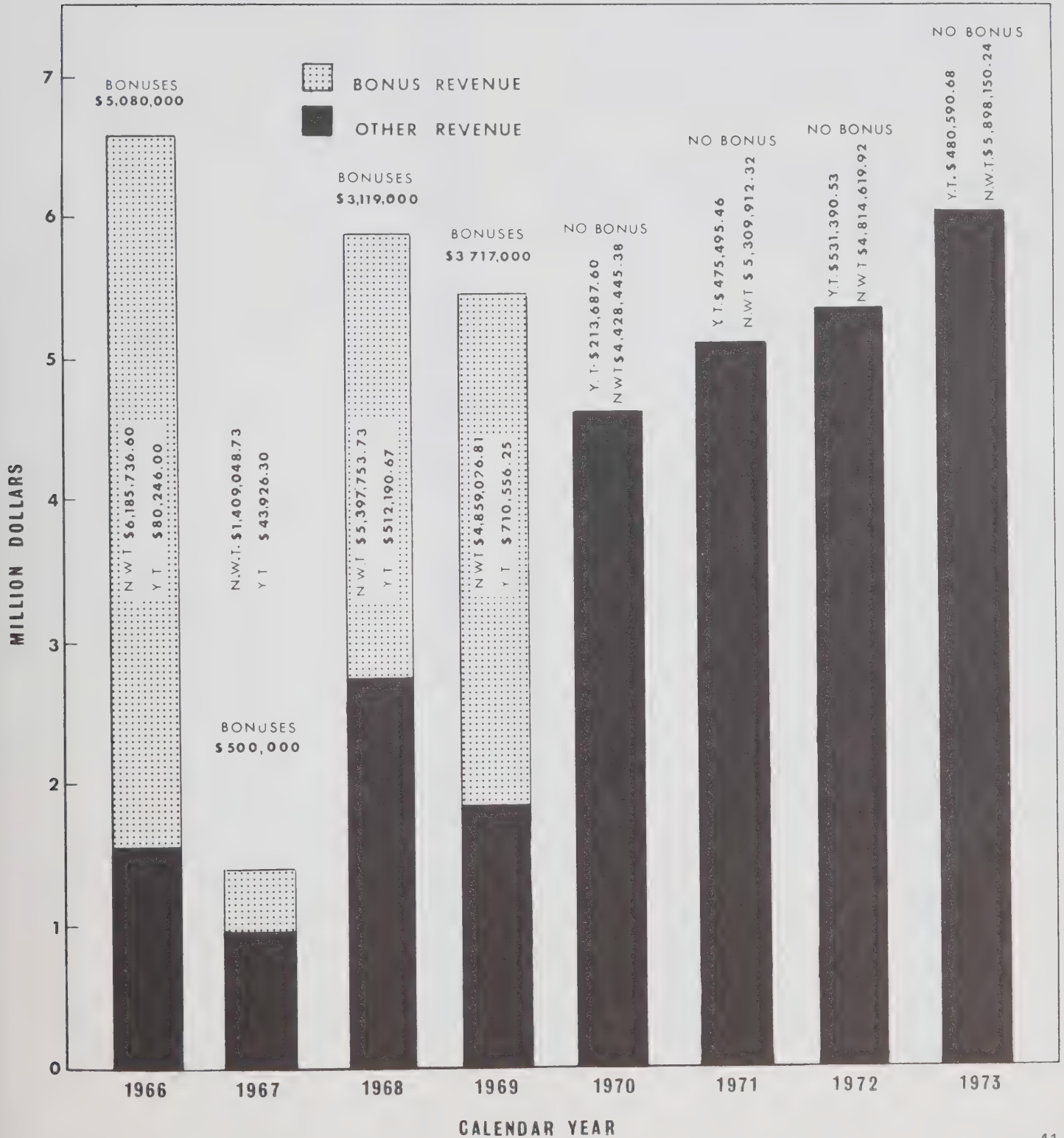


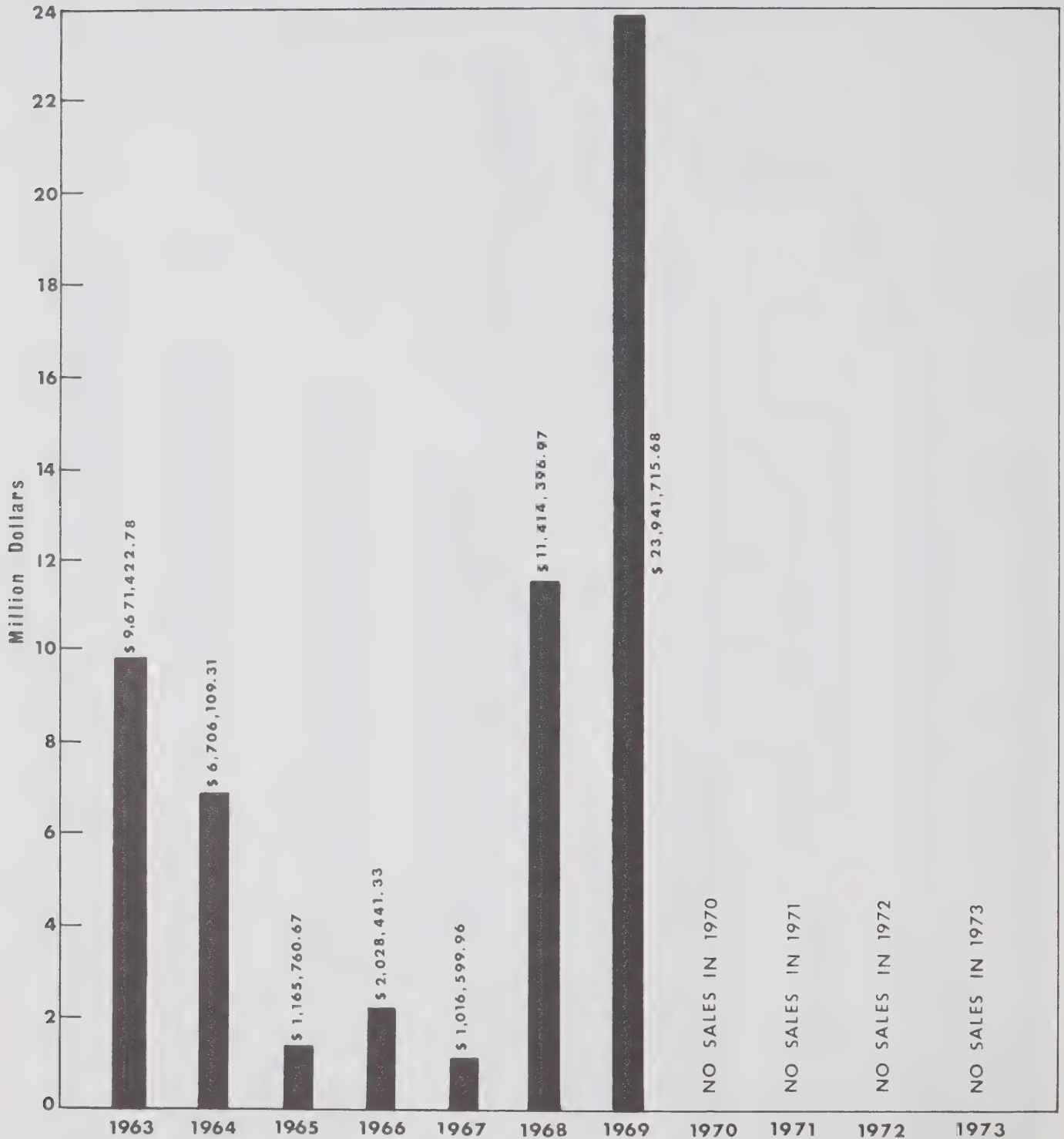
Fig.13

VALUE OF WORK BONUS TENDERS-OIL & GAS

YUKON TERRITORY AND NORTHWEST TERRITORIES

NOTE: Cumulative Value End of Dec.1969

\$58,896,608.91



Limited and its American affiliate Shell Explorer Limited, and as supplier of capital and market the Calgary-based Alberta and Southern Gas Co. Ltd., a unit of Pacific Gas and Electric Company of San Francisco.

Under the contract, Alberta and Southern will be advancing interest-free loans for exploration and development of the Shell Group properties on the Mackenzie Delta, and has been granted rights to purchase up to nine trillion cubic feet from the first 12 trillion cubic feet of gas discovered under the Shell properties. (The remaining three trillion of that gas volume is uncommitted, and presumably could be expected to help ensure future gas supplies for Canadian markets).

Imperial committed five trillion cubic feet to Natural Gas Pipeline Company of America and five trillion to Michigan Wisconsin Pipeline Company, keeping out two trillion cubic feet from the initial 12 trillion of reserves found on Imperial's properties. The two U.S. utilities plan to use their supply in the American Midwest and Great Lakes region.

Gulf Oil Canada Limited was the second to enter into a funding and gas sales contract. Gulf committed two trillion cubic feet to Alberta and Southern Gas Co. Ltd., the purchasing agency for the Northern California gas utility, and two trillion cubic feet to Pacific Lighting Gas Development Company, a unit of a major gas utility in Southern California. The two utilities also obtained from Gulf an option on a further one trillion cubic feet each.

In total the three major discovery groups in Canada's Mackenzie Delta have entered into funding and sales contracts under which 23 trillion cubic feet of natural gas from their properties may be developed, at ultimate costs of several hundred million dollars in interest-free advances from American utilities. A further total of seven trillion cubic feet will be withheld and thus will be available for Canadian markets.

The total of committed and withheld gas potential thus stands at 30 trillion cubic feet for the Mackenzie Delta. The total is not a measure of gas reserves actually proved up in the Delta

on Shell, Imperial and Gulf properties. Much more drilling must be done to evaluate the one and two-well discoveries before reserves to the extent of 30 trillion cubic feet are proved.

Ministry of Transport to upgrade Arctic Air Navigational Facilities

A \$3.7 million program to expand and upgrade air navigation facilities in the Canadian Arctic has been set up by the federal Ministry of Transport in response to requests from carriers in the Yukon and Northwest Territories.

Very high frequency omni-range and distance measuring equipment will be installed at Yellowknife, Resolute Bay, Whitehorse, Frobisher Bay and Cambridge Bay. Construction of VOR/DME facilities at Fort Simpson, Norman Wells, Inuvik and Watson Lake was planned for the summer of 1973.

Environmental testing of a developmental VOR/DME package designed for Arctic conditions was to begin after installation in March at Cambridge Bay. The VOR/DME pinpoints an aircraft along a line in any direction from the station, and with distance measuring equipment the pilot can determine how far he is from the station along the line.

In conjunction with the Department of Indian and Northern Affairs (DIAND) and the government of the Northwest Territories, the Ministry of Transport provides landing strips, air terminal buildings and radio aids to air navigation in communities where sufficient need has been shown.

Revenues

While no sales of oil and gas rights were held in 1973, revenues governing the Northern operations during the calendar year approximated \$6.6 million. (See Table 6 and Figure 12). Revenues from all sources for the fiscal year are shown in Table No. 5 and Figure No. 11. Figure No. 13 depicts the annual value of work bonus for oil and gas work bonus blocks and permits. Cumulative value of work bonus to the end of 1971 is approximately \$59 million.

Table 5 Gross Revenue Oil and Gas (By Fiscal Year)

NORTHWEST TERRITORIES

Fiscal Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	Total
1968-69	\$ 2,675.00	\$ 932,750.00	\$ 49,715.00	\$ 1,090.00	\$ 1,576,734.76	\$ 35,092.00	\$ 374,468.96	\$5,574,369.85	\$ 1,966.60	\$ 8,548,862.17
1969-70	3,800.00	391,692.70	59,080.00	2,240.00	2,093,730.05	19,630.00	19,852.44	—	2,296.10	2,592,321.29
1970-71	5,800.00	101,508.60	60,921.52	1,450.00	3,396,332.82	244,072.00	729,500.39	—	1,930.17	4,541,515.00
1971-72	5,550.00	400,000.00	52,105.00	1,110.00	4,182,655.72(1)	394,083.00	476,328.66	—	1,848.71	5,513,681.09
1972-73	2,950.00	234,500.00	41,965.00	3,200.00	4,493,538.70(2)	264,805.00	384,624.03	—	553.27	5,425,736.00
1973-74	4,100.00	189,500.00	19,440.00	2,170.00	4,808,931.18(3)	731,399.22	188,606.71	—	5,022.14	5,949,169.25
TOTAL	24,475.00	2,249,951.30	283,226.52	11,260.00	20,551,923.23	1,689,081.22	2,173,381.19	5,574,369.85	13,616.99	32,571,285.30

(1) Permit Renewals (Rental) — Special (\$1,607,455.50)

(2) Permit Renewals (Rental) — Special (\$1,163,492.75)

(3) Permit Renewals (Rental) — Special (\$1,283,214.50)

YUKON TERRITORY

1968-69	—	82,000.00	875.00	330.00	27,939.25	—	7,845.90	936,526.37	—	1,055,516.52
1969-70	—	10,250.00	—	—	30,749.50	—	—	—	—	40,999.50
1970-71	—	4,750.00	25.00	190.00	364,604.75	—	41,306.56	—	—	410,876.31
1971-72	—	—	410.00	85.00	120,688.25(4)	11,036.23	—	—	—	132,219.48
1972-73	—	750.00	—	2,950.00	458,756.50	25,750.74	—	—	—	488,207.24
1973-74	—	3,500.00	—	—	357,644.38	15,708.44	—	—	—	376,852.82
TOTAL	—	101,250.00	1,310.00	3,555.00	1,360,382.63	52,495.41	49,152.46	936,526.37	—	2,504,671.87

(4) Permit Renewals (Rental) — Special (24,960.00)

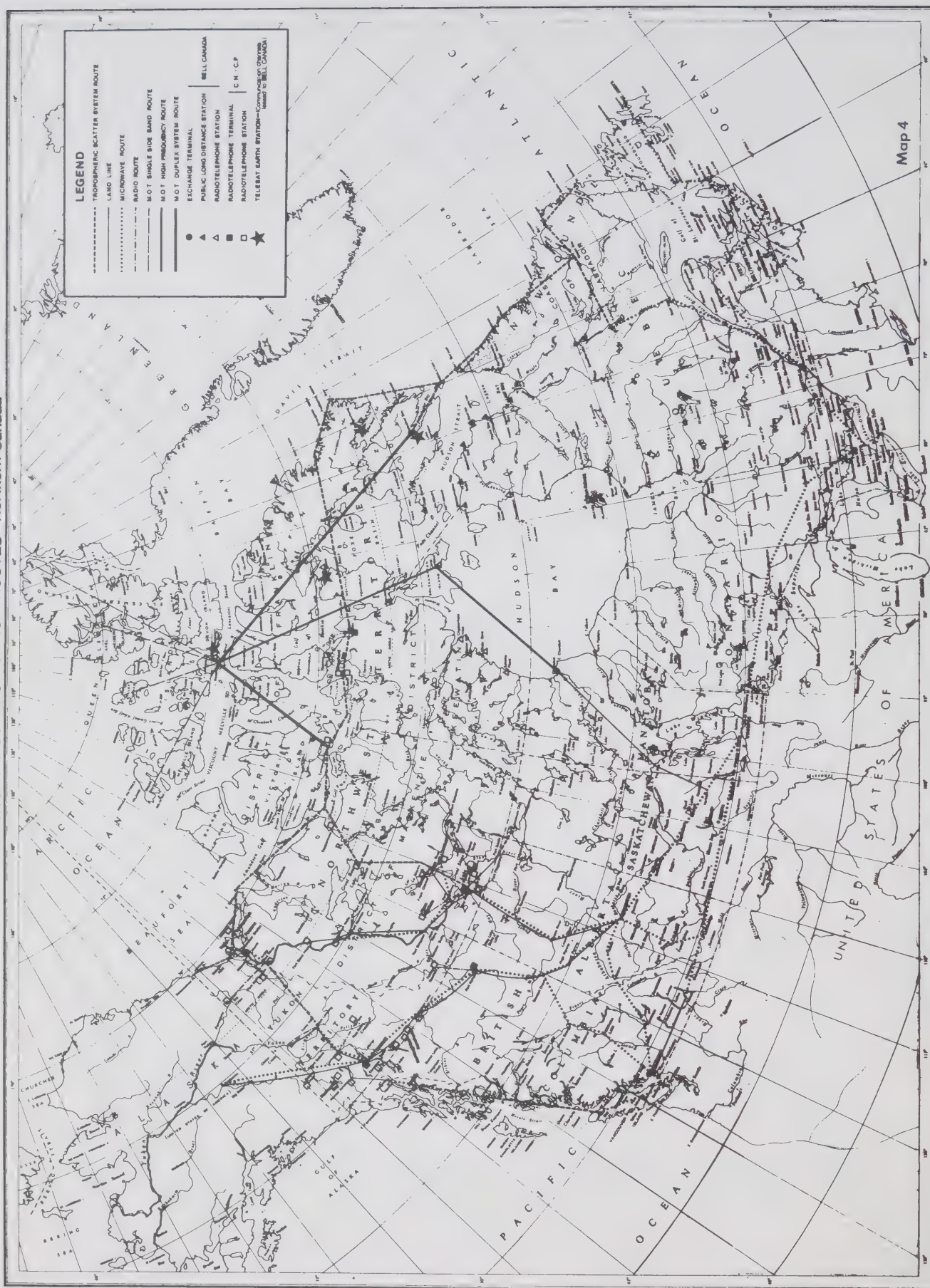
GRAND TOTAL REVENUES

1968-69	9,604,378.69
1969-70	2,633,320.79
1970-71	4,952,391.81
1971-72	5,645,900.57
1972-73	5,913,943.24
1973-74	6,326,022.07
TOTAL	35,075,957.17

Table 6 — Gross Revenue Oil and Gas (By Calendar Year)
NORTHWEST TERRITORIES

Year	Licence Fee	Permit Fee	Transfer Fee	Lease Fee	Rentals	Royalties	Forfeiture	Cash Bonus	Misc.	Total
1968	2,298.18	652,800.00	32,780.00	1,830.00	1,405,916.76	35,092.00	394,254.08	2,871,080.66	1,702.07	5,397,753.75
1969	2,000.00	320,701.30	45,540.00	1,290.00	1,404,600.82	19,630.00	19,852.44	3,043,711.52	1,700.73	4,859,026.81
1970	5,175.00	141,250.00	56,350.00	1,960.00	3,315,524.09	244,072.00	661,828.60	—	2,285.69	4,428,445.38
1971	4,900.00	395,500.00	55,806.52	1,130.00	4,070,722.82(1)	394,083.00	478,609.95	—	1,681.03	5,402,433.32
1972	4,525.00	231,500.00	37,795.00	3,150.00	4,136,291.41(2)	248,040.96	251,701.28	—	1,077.27	4,914,080.92
1973	4,100.00	183,500.00	30,235.00	1,950.00	4,836,714.92(4)	750,769.46	359,957.30	—	4,441.03	6,171,667.71
Total	22,998.18	1,925,251.30	258,506.52	11,310.00	19,169,770.82	1,691,687.42	2,166,203.65	5,914,792.18	12,887.82	31,173,407.89
(1) Permit Rental — Special Renewals (\$1,528,189.50)										
(2) Permit Rental — Special Renewals (\$1,002,534.75)										
(4) Permit Rental — Special Renewals (\$1,444,172.50)										
YUKON TERRITORY										
1968	—	86,750.00	875.00	330.00	27,939.25	—	147,680.76	248,615.66	—	512,190.67
1969	—	8,500.00	—	—	30,749.50	—	—	671,306.75	—	710,556.25
1970	—	1,750.00	—	140.00	182,448.00	—	29,349.60	—	—	213,687.60
1971	—	4,750.00	360.00	275.00	423,944.50(3)	4,660.40	41,506.56	—	—	475,496.46
1972	—	750.00	75.00	2,950.00	507,079.00	20,536.53	—	—	—	531,390.53
1973	—	3,500.00	—	—	417,142.38	25,649.09	—	—	—	446,291.47
Total	—	106,000.00	1,310.00	3,695.00	1,589,302.63	50,846.02	218,536.92	919,922.41	—	2,889,612.98
(3) Permit Rental — Special Renewals (\$24,960.00)										
GRAND TOTAL REVENUES										
1968	5,909,944.42									
1969	5,569,583.06									
1970	4,642,132.98									
1971	5,877,929.78									
1972	5,445,471.45									
1973	6,617,959.18									
TOTAL	34,063,020.87									

PRINCIPAL COMMUNICATION ROUTES - Northern Canada



QUEEN ELIZABETH ISLANDS

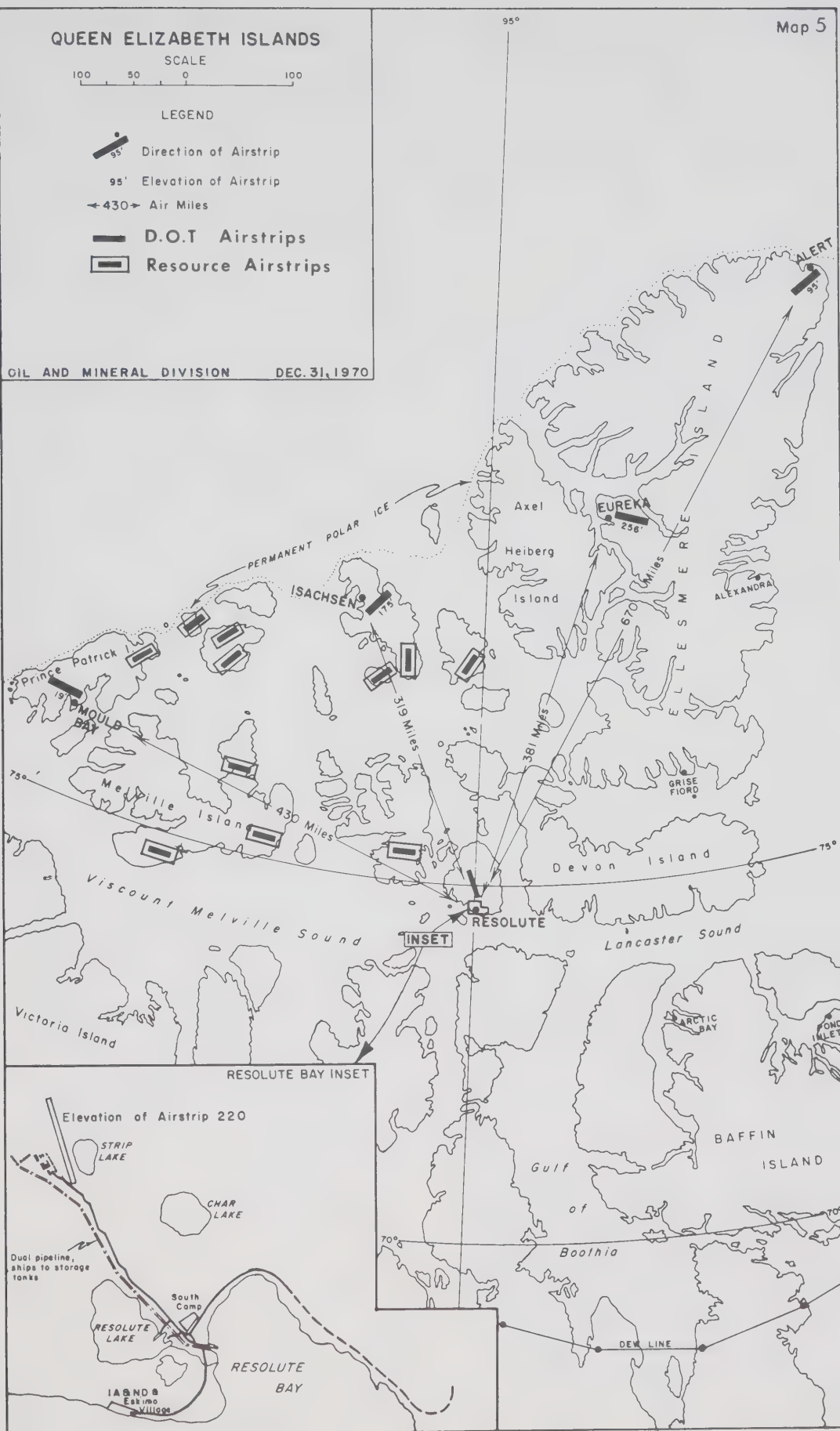
Map 5

SCALE
100 50 0 100

LEGEND

- Direction of Airstrip
- 95' Elevation of Airstrip
- 430 Air Miles
- D.O.T. Airstrips
- Resource Airstrips

OIL AND MINERAL DIVISION DEC. 31, 1970



Appendix I

Publications

A. Maps

Many maps dealing with the northern resource activities are published by the Oil and Minerals Division and are available from the Oil and Gas Land and Exploration Section, Calgary, Alberta, or from the Assistant Director, Oil and Minerals Division, Ottawa. The Division publishes a list of maps which may be obtained from either of the above sources.

B. The following reports may be obtained from Information Canada or the Oil and Gas Land and Exploration Section, Calgary. Pre-payment is required.

Schedule of Wells 1920-1960	— \$ 3.00 (out of print)
Schedule of Wells 1920-1961	— 4.00 (out of print)
Schedule of Wells 1920-1963	— 4.00 (out of print)
Schedule of Wells 1920-1964	— 2.00 (out of print)
Schedule of Wells 1965	— 3.00 (out of print)
Schedule of Wells 1966	— 3.00 (out of print)
Schedule of Wells 1967	— 2.50
Schedule of Wells 1968	— 2.50
Schedule of Wells 1969	— 2.50
Schedule of Wells 1970	— 2.50
Schedule of Wells 1921-1971	— 10.00
Schedule of Wells 1972	— 5.00
Schedule of Wells 1973	— 5.00

Oil and Gas Statistics Report
No. 1 (1920-1960) — 2.50 (out of print)

Oil and Gas Statistical Report
No. 2 (1961-1970) — in preparation

"Technical Reports available for Inspection 1974."

(Geological and Geophysical Reports released from confidential status are available for public inspection only in the office of the Oil and Gas Land and Exploration Section of this Department in Calgary). — no charge

Other Sources of Information

Information on northern resource activities can be obtained from the Assistant Director, Oil and Minerals Division, Department of Indian and Northern Affairs, 400 Laurier Avenue West, Ottawa. All cores and samples from wells drilled on Canada lands north of 60 N. latitude are stored at the Institute of Sedimentary and Petroleum Geology, 3303-33rd. St. N.W., Calgary, Alberta. Only samples and cores which have met the requirements for information release under the *Canada Oil & Gas Land Regulations* and the Canada Drilling Production Regulations can be inspected. A list of such wells may also be obtained from the Assistant Director.

Specialized and technical literature pertaining to Northern Canada can be purchased or perused at the following government agencies:

- (a) Northern Co-ordination Division Library, Department of Indian and Northern Affairs, 400 Laurier Avenue West, Ottawa, Ontario.
 - (1) Oil and Gas Land and Exploration Section, Department of Indian and Northern Affairs, Calgary.
- (b) Department of Energy, Mines and Resources.
 - (1) Geological Survey of Canada — Ottawa and Vancouver, B.C.
 - (2) Institute of Sedimentary and Petroleum Geology — Calgary, Alberta.
 - (3) Atlantic Geoscience Centre, Bedford Institute of Oceanography — Dartmouth, Nova Scotia.
 - (4) Earth Physics Branch — Ottawa.
- (c) Defence Research Board, Scientific Information Service — Ottawa.
- (d) Ministry of Transport
 - (1) Marine Works Branch — Ottawa, Ontario.
 - (2) Marine Operations Branch — Ottawa, Ontario.
 - (3) Telecommunications and Electronics Branch — Edmonton, Alberta and Ottawa, Ontario.
 - (4) Civil Aviation Branch — Winnipeg, Manitoba.
- (e) Arctic Institute of North America — Montreal, Quebec.
- (f) National Research Council — Ottawa, Ontario.
- (g) The following brochures published by this Department may be available in some Public Libraries:
 - i Guide to Northern Non-Renewable Resources
 - ii Communication and Transportation Facilities Queen Elizabeth Group — Arctic Islands
 - iii Resource Management Division — Responsibilities and Administration
 - iv Oil and Gas Canada Lands — Volume No. 2
 - v Oil and Gas Canada Lands — Edition No. 3
 - vi Oil and Gas in the Yukon and Northwest Territories — Edition No. 4 — 1967
 - vii Oil and Gas — North of 60 — 1968
 - viii Oil and Gas — North of 60 — 1969
 - ix Oil and Gas — North of 60 — 1970
 - x Oil and Gas — North of 60 — 1971
 - xi Oil and Gas — North of 60 — 1972
 - xii Prospectus — North of 60

Information and Procedures Concerning Operations on Canada Lands

Certain federal agencies are concerned with exploration on Canada lands and must be notified prior to the commencement of any exploration activity. The operator or permittee,

not the contractor, is responsible for providing the requisite advance notice of planned programs to these agencies by writing directly to them.

For offshore programs the Regional Director of Resources at Yellowknife, Northwest Territories, in addition to the Oil and Minerals Division, must be informed with respect to each program. He will communicate with every department and agency on a need-to-know basis with respect to Marine Geophysical Programs. In the case of the Hudson Bay region, operators must also inform the National Research Council of proposed operations to be undertaken during the summer months.

Circumstances may be such that other agencies should be notified as well, and these are listed on the following pages, together with the names of persons who can be of assistance. For example, since operators are responsible for any damage they may cause to underwater commercial cables, it is recommended that they contact the Canadian Hydrographic Service for cable-lay data covering the area over which the work is to be performed. Similarly, the Customs and Excise Department should be contacted by the importing company if vessels or equipment are to be brought in from abroad.

Department of Indian and Northern Affairs

1. Pursuant to Section 52 of the Canada Oil and Gas Land Regulations, "Notice of Commencement of Exploratory Work" must be filed 15 days prior to commencement of proposed exploratory programs (geophysical, geological and research) on the mainland in the Northwest Territories and Yukon Territory and Arctic Islands, and 45 days prior to commencement of geophysical work on offshore areas with the,

Oil and Gas Land and Exploration Section,
Oil and Minerals Division,
Department of Indian and Northern Affairs,
112-11th Avenue S.E.,
Calgary, Alberta,
T2G 0X5

2. Information and assistance may be obtained from:
Assistant Director,
Oil and Minerals Division,
Northern Natural Resources and Environment Branch,
Department of Indian and Northern Affairs,
400 Laurier Avenue West,
Ottawa, Ontario.
Name: Dr. H.W. Woodward
Phone: 613-992-0223

or from:

Administrator, Oil and Gas,
Oil and Minerals Division,
Department of Indian and Northern Affairs,
400 Laurier Avenue West,
Ottawa, Ontario.
Name: R.R. McLeod
Phone: 613-995-8944

3. Advice on exploratory programs and operational matters may be obtained from:
Head, Operations Unit,
Oil and Minerals Division,
Northern Natural Resources and Environment Branch,
Department of Indian and Northern Affairs,
Ottawa, Ontario.
Name: S.A. Kanik
Phone: 613-995-7589
4. Drilling authority and advice on drilling matters can be obtained from the District Conservation Engineer for the District. See Map No. 7 for description of District outlines.

Oil and Gas Drilling and Conservation Section

- | | |
|--|--|
| Chief Petroleum Engineer | — |
| Head, Drilling and Completion Engineering Unit | — M.K. El-Defrawy |
| Head, Offshore Petroleum Engineering Unit | — S.V. Benediktson |
| Head, Production Systems Engineering Unit | — R.L. Price |
| Head, Reservoir Engineering Unit | — |
| Regional Oil and Gas Conservation Engineer, N.W.T. | — M.D. Thomas in Yellowknife |
| Regional Oil and Gas Conservation Engineer, Y.T. | — A.F. Halcrow in Whitehorse |
| District Oil and Gas Conservation Engineers | — for Arctic Islands in Calgary, District 1, N.W.T.
— G.E. Blue for Southern Sector, N.W.T. in Yellowknife, District 2, N.W.T.
— J. Kirk for the N.W. Sector N.W.T. in Inuvik, District 3, N.W.T.
— for Offshore, in Inuvik, District 4, N.W.T. |
5. A Land Use Permit must be acquired for every land use operation, including drilling operations. Information and advice on the Land Use Regulations and Land Use Permits can be obtained:

For the Northwest Territories:

Regional Director of Resources,
P.O. Box 1500,
Yellowknife, N.W.T.
Name: G.B. Armstrong
Phone: 403-873-4421

For the Yukon Territory:

Regional Director of Resources,
Room 200, Takhini Building,
Whitehorse, Y.T.
Name: B.J. Trevor
Phone: 403-667-7861

Department of Energy, Mines and Resources

(A) Resource Management and Conservation Branch

The Resource Management and Conservation Branch is responsible for the administration of federal interest in the mineral resources off Canada's east and west seacoasts and in the Hudson Bay and Hudson Strait regions.

All correspondence should be addressed to:
Director,
Resource Management and Conservation Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Name: D.G. Crosby
Phone: 613-995-8655

(B) Surveys and Mapping Branch

Information on the systems, methods and equipment utilized in positioning and surveying with respect to exploration work may be subject to review by this agency. Moreover, legal surveys must be made in accordance with instructions of the Surveyor General.

Inquiries concerning surveying may be directed to:
Surveyor General,
Legal Surveys Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
K1A 0E9
Name: D.R. Slessor
Phone: 613-994-9174

Information concerning coastal control surveys may be obtained from:
Geodetic Survey Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
K1A 0E9
Attention: C.E. Hoganson
Phone: 613-994-5079

When requesting control survey data, the inquiries should define the area involved by latitude and by longitude. In the case of a large area, it is important to state priorities within the area to facilitate processing.

Air photographs covering all portions of Canada may be obtained from:

National Air Photo Library,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
K1A 0E9
Attention: P. Andrews
Phone: 403-994-5433
and

Publications and Air Photo Section,
Institute of Sedimentary and Petroleum Geology,
3303-33rd St. N.W.,
Calgary, Alberta.
T2L 2A7
Attention: Mrs. M.H. Brooks
Phone: 403-284-0110

Topographic maps, indices, charts, atlases and numerous other map publications may be obtained from:

Canada Map Office,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Attention: G.A. Clemmer
Phone: 613-994-9663

and

Publications and Air Photo Section,
Institute of Sedimentary and Petroleum Geology,
3303-33rd St. N.W.,
Calgary, Alberta
T2L 2A7
Attention: Mrs. M.H. Brooks
Phone: 403-284-0110

(c) Geological Survey of Canada

The Geological Survey of Canada carries out systematic geological and geophysical surveys in the sedimentary basins of Canada, including parts of the regions offshore from the east and west coasts, in Hudson Bay, and in the Arctic Islands.

Inquiries with regard to the operations and publications of the Geological Survey should be made to:
Director,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Name: D.J. McLaren
Phone: 613-994-5817

or to:

Director,
Institute of Sedimentary and Petroleum Geology,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Calgary, Alberta.
Name: D.F. Stott
Phone: 403-284-0110

(D) Polar Continental Shelf Project

The Polar Continental Shelf Project is a continuous investigation of the continental shelf fringing the Arctic coast of Canada, together with adjacent parts of the Arctic Ocean

basin, the islands of the Canadian Arctic Archipelago and the waters between them, and other areas of special interest.

Inquiries regarding surveys and scientific studies in Arctic areas may be directed to:

Co-ordinator,
Polar Continental Shelf Project,
Department of Energy, Mines and Resources,
Ottawa, Ontario.
Name: G. Hobson
Phone: 613-996-3388

(E) *Earth Physics Branch*

The Earth Physics Branch operates a network of Arctic geophysical observatories, carries out systematic gravity and geomagnetic surveys throughout Arctic Canada and makes geothermal, permafrost, seismological, geomagnetic, gravity and related studies throughout Canada including the Arctic.

Inquiries with regard to the scientific studies, surveys and publications of the Earth Physics Branch should be directed to:

Director,
Earth Physics Branch
Department of Energy, Mines and Resources,
Ottawa, Ontario.
K1A 0E4
Name: K. Whitman
Phone: 613-994-5253

Department of the Environment

(A) *Resource Development Branch*

Advance notice of 90 days is required before the start of drilling operations and all seismic activities, including marine seismic surveys involving the use of high explosives, in the event that qualified observers are needed. Notice of 15 days to the Regional Director is required before the start of a seismic survey in which a source of acoustical energy other than high explosives is to be used.

Written notices should be sent to the appropriate Regional Director of Fisheries with a copy to:
Assistant Deputy Minister,
Environment Protection Service,
Department of the Environment,
15th Floor, Place Vincent Massey,
Ottawa, Ontario.
K1A 0H3
Name: L. Edgeworth
Phone: 613-997-1575 or 997-1576

Information regarding the Department's requirement can also be obtained from:

A/Director,
Resource Development Branch,
Name: E.R. Burrige
Phone: 613-997-1010

The address of the Regional Director responsible for all fresh water lakes in the Northwest Territories is:

Name: C. McEwan
Address: 114 Gary Street
Winnipeg, Manitoba
Phone: 204-946-8101

In the Yukon Territory is:

Name: W.R. Hourston
Address: 1091 West Pender Street,
Vancouver 1, B.C.
Phone: 604-666-1671

Information concerning wildlife such as the locations of migratory bird sanctuaries and National Wildlife Areas may be obtained from:

Director,
Canadian Wildlife Service,
Department of the Environment,
16th Floor, Place Vincent Massey,
Ottawa, Ontario.
K1A 0H3
Name: N.G. Perret
Phone: 613-997-1270

(B) *Atmospheric Environment Service*

Requests for information and assistance on meteorological and sea-ice data, climatology, weather forecasting, meteorological instruments and research may be directed to:

Assistant Deputy Minister,
Atmospheric Environment Service,
Department of the Environment,
4905 Dufferin Street,
Downsview, Ontario.
Name: J.R.H. Noble
Phone: 416-667-4760

Information may also be obtained through the Meteorological Liaison Officer in Ottawa. This position is filled on a rotation basis and the name of the officer is subject to change.

Inquiries in Ottawa may be directed to:

Liaison Meteorologist,
Department of the Environment,
Fontaine Building,
Ottawa, Ontario.
K1A 0H3
Name: D.J. Wright
Phone: 613-997-1588

(C) *Marine Sciences Branch*

In addition to providing the commercial-cable lay data, the Canadian Hydrographic Service publishes charts of Canadian coastal waters.

Information concerning these may be obtained from:
Canadian Hydrographic Service,
Marine Sciences Directorate,
615 Booth Street,
Ottawa, Ontario.
K1A 0E7
Attention: W.J. Covey
Phone: 613-994-9155

Information concerning charts showing Canada's Territorial Sea and Fishing Zone Limits and related data may be obtained from:

Canadian Hydrographic Service,
Marine Sciences Directorate,
615 Booth Street,
Ottawa, Ontario.
K1A 0E7
Attention: E.J. Cooper
Phone: 613-994-5411

Information on physical oceanography may be obtained from:

Canadian Oceanographic Data Centre,
Marine Sciences Directorate,
615 Booth Street,
Ottawa, Ontario.
K1A 0E7
Attention: C.M. Cross
Phone: 613-992-3940*

Information on tides may be obtained from:

Tides and Water Levels,
Marine Science Directorate,
No. 8 Temporary Building,
Ottawa, Ontario.
K1A 0E6
Attention: G.C. Dohler
Phone: 613-994-9122

Information on hydrographic surveys and control data in the eastern Arctic may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
Atlantic Oceanography Laboratory,
Bedford Institute,
Dartmouth, Nova Scotia.
Name: R.C. Melanson
Phone: 902-426-3497

Information on Hydrographic surveys and control data in the western Arctic may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
512 Federal Building,
Victoria, B.C.
Name: M. Bolton
Phone: 604-338-3188

Department of National Defence

Maritime Command

The appropriate Office of Maritime Command will be advised on the need-to-know basis by the Regional Director of Resources of any exploration program proposed for the offshore.

Operations in Baffin Bay and Arctic waters east of longitude 105 West are handled by the office of:

Commander Maritime Command,
Department of National Defence,
F.M.O. HMC Dockyard,
Halifax, Nova Scotia.

Operations in Arctic waters west of longitude 105 West are handled by the office of:

Commander Maritime Forces Pacific,
Department of National Defence,
F.M.O. HMC Dockyard,
Victoria, B.C.

Ministry of Transport

(A) Aids to Navigation Division

At least 60 days notice is required by this Division before the commencement of any offshore exploration program in order that appropriate local Notices to Shipping and national Notices to Mariners may be issued. These Notices are subsequently copied into related foreign publications.

The Division also indicates the requirement for any aids to navigation devices that may be necessary for the program.

Advance notice of 90 days is required in any case where drilling involves the territorial sea, in order for approval to be granted under the Navigable Waters Protection Act.

All communications on these matters should be directed:

Chief, Aids to Navigation,
Marine Works Branch,
Ministry of Transport,
Ottawa, Ontario.
Phone: 613-992-2736

In addition there are a number of Departmental officers who may be contacted in the field should the need arise. Their titles and addresses are given below:

(i) District Marine Agent,
Ministry of Transport
P.O. Box 310, Uppertown,
Quebec 4, Quebec.
(This office handles Hudson Bay)

(ii) District Manager,
Ministry of Transport,
P.O. Box 155,
Hay River, N.W.T.
Phone: 403-874-2331

(B) Marine Operations Branch

This agency directs the operations of the Canadian Coast Guard which has major responsibilities in two areas of concern of offshore operations: support of shipping in ice-congested waters, and marine search and rescue.

If operations are being contemplated for areas where ice may be a problem and where ice-breaker or other support may be desired, there should be consultation with the Director of Marine Operations as long in advance as possible. This is particularly important in the case of Arctic and Hudson Bay operations where the planning of ice-breaker disposition is usually done six months in advance of the season.

Further information and assistance may be obtained from:
Director,
Marine Operations Branch,
Ministry of Transport,
Ottawa, Ontario.

Note*: Possible change in phone number in the near future.

(C) *Marine Safety Branch*

This Branch includes the Steamship Inspection Division and the Nautical Division. The responsibilities of the Steamship Inspection Division include inspection and certification of vessels under the Canada Shipping Act and oil pollution by vessels. The Nautical Division Deals with marine accident investigation and inquiries, ship registry, salvage, marine personnel and navigational safety matters. This last includes the establishment of restricted navigation areas and the routing of ships.

Further information and assistance may be obtained from:
Director,
Marine Safety Branch,
Ministry of Transport,
Ottawa, Ontario.
Name: G.W.R. Graves
Phone: 613-992-8892

(D) *Pollution Contingency Office*

This agency is responsible for the contingency planning function of the Ministry of Transport and also provides co-ordination and assistance when a federal response is made to combat a spill of oil or toxic materials into the marine environment. The response is made under the Interim Federal Contingency Plan, or in the case in international boundary waters, the appropriate Joint International Plan.

Further information and assistance may be obtained from:
Pollution Contingency Office,
Ministry of Transport,
Tower "C", Place de Ville,
Ottawa, Ontario.
K1A 0N7
Name: W.J.H. Stuart
Phone: 613-992-9743 or 992-9210

Department of Communications

The responsibilities of this agency include the development of technical standards, the selection and co-ordination of radio frequencies, and the licensing of all classes of radio station except broadcasting.

An operator contemplating the use of radio-communications in his offshore activities should make application for licensing of any radio station in Canada or on board any Canadian vessel involved at least six weeks before the proposed in-service date of the communication facility. Details as to the licensing requirements and the necessary application forms may be obtained from the following addresses:

In Ottawa:
Director,
Operational Standards and Procedures Branch,
Communications Canada,
100 Metcalfe Street,
Ottawa, Ontario.
K1A 0C8
Phone: 613-992-3427 or 992-7259

Companies in Western Canada may contact:
Regional Director, Pacific Region,
Communications Canada,
325 Granville Street, Room 320
Vancouver, B.C.
Phone: 604-666-1469

Regional Director, Central Region,
Communications Canada,
266 Graham Avenue, Room 600
Winnipeg, Manitoba.
R3C 0K7
Phone: 204-985-4081

District Manager,
Communications Canada,
205-8th Avenue S.E., Room 803
Calgary, Alberta.
T2G 0K9
Phone: 403-262-3058 or 262-3416

District Manager,
Communications Canada,
Financial Bldg., Room 300
10621-100 Avenue
Edmonton, Alberta.
T5J 0B4
Phone: 403-425-5189

Companies in Northern Canada may contact:
District Manager,
Communications Canada,
P.O. Box 540
Fort Smith, N.W.T.
X0E 0P0
Phone: 403-872-2187

District Manager,
Telecommunications Regulations Office,
Communications Canada,
Federal Bldg., Room 230
Whitehorse, Y.T.
Phone: 403-667-7197

Companies in Eastern Canada may contact:
Regional Director,
Communications Canada,
7th Floor,
Terminal Plaza Building,
1222 Main Street,
Moncton, N.B.
Phone: 506-858-2213

**National Research Council
*Space Research Facilities Branch***

Operators planning offshore activities in the Hudson Bay region must inform the following agency of the National

Research Council well in advance since rockets are fired on a year round basis from the Churchill River Range:

Head,
Range Section,
Space Research Facilities Branch,
National Research Council,
Ottawa, Ontario.
K1A 0R6
Name: Z.R. Charko
Phone: 613-993-9385

Operators active in the Hudson Bay region are also required to co-ordinate their field activities with:

Superintendent,
Churchill Research Range,
National Research Council,
Fort Churchill, Manitoba,
R0B 0K0
Name: C.R. Barrett
Phone: 204-856-3010

Rockets are also launched from time to time from the facilities at Resolute Bay, N.W.T. and Cape Parry, N.W.T. Operators with exploration work planned for this vicinity are urged to co-ordinate their activities with the National Research Council.

Department of National Revenue

Customs and Excise

The Headquarters Operations Directorate administers that portion of the Canada Shipping Act that relates to the coasting trade. In this connection, any company importing ships or specialized plant and equipment for exploration work on Canada's seacoasts and among the Arctic Islands may obtain information, assistance and such other contracts as may be necessary in Customs and Excise from:

Director,
Headquarters Operations,
Customs and Excise,
Department of National Revenue,
Ottawa, Ontario. K1A 0L5
Name: R.A. Mclean
Phone: 613-992-4952

Canada Immigration Division

Inquiries should be directed to:
Department of Manpower and Immigration,
Home Branch,
Canada Immigration Division,
Admissions Facilitation
Ottawa, Ontario.
Attention: Mr. F.J. Murphy
Phone: 613-992-3953

The Winnipeg and Edmonton offices of the Department of Manpower and Immigration can answer any queries regarding entry into the Northwest Territories. The Vancouver office can respond to queries for entry into the Yukon Territory.

At Tuktoyaktuk, a local R.C.M.P. officer is also a representative for Manpower and Immigration and can clear entry into Canada via Tuk.

At Inuvik, the Customs Department is also Departmental representative for Manpower and Immigration and can be contacted by telephone if prior arrangements are necessary. There is no representative at Aklavik; in the event that a seismic crew prefers to land at Aklavik, arrangements must be made with the Inuvik representative.

Communications

Information in the brochure "Communications and Transportation Facilities Queen Elizabeth Group, Arctic Islands", is being updated and will be available in a comprehensive report entitled "Operational Guide for Oil and Gas Companies in the North". This publication is now in preparation and should be available by October 1974. In addition to information concerning communication and transportation, the report will contain information covering all aspects of exploration in the North.

Appendix II

Oil and Gas Discoveries North of 60°

Northwest Territories — Arctic Islands

Well Name	Location	Well Status	Reserve Status	Horizon	Lithology	Spud Date	Completion Date	Potential
Crude Oil Discoveries								
Ellesmere Island								
Panarctic Romulus C-42	C-42 80-00-84-00	Suspended	Oil & Gas Show	Jurassic Schei Point Bjorne	Sand-Stone	29-01-72	25-07-72	Area has potential
Thor Island								
Panarctic et al Thor P-38	P-38 78-10-	Suspended	Oil Show	Heiberg	Sand-stone	06-04-72	10-05-72	Thin Oil leg on water
Cameron Island								
Panarctic et al Bent Horn N-72	N-72 76-30-108-30	Oil & Gas Well				24-11-73	06-04-74	
Gas Discoveries								
Melville Island								
Panarctic Drake Point N-67	N-67 76-30-108-30	Abandoned	Gas Discovery	Jurassic	Sand-stone	14-04-69	02-09-69	Abandoned after blowout
Panarctic Drake Point L-67	L-67-76-30-108-30	Dual Gas	Gas Dev.	Jurassic Bjorne	Sand-stone	28-09-69	26-02-70	DST 10 MMCF (Jurassic)
Panarctic et al Drake F-16	F-16-76-30-108-30	Gas	Gas Dev.	Jurassic	Sand-stone	10-05-72	16-06-72	
Panarctic et al Drake B-44	B-44-76-30-108-30	Gas	Gas Dev.	Jurassic	Sand-stone	23-09-72	22-10-72	
Panarctic et al Hecla F-62	F-62-76-30-110-00	Gas	Gas Discovery	Jurassic	Sand-stone	11-11-72	12-12-72	
Panarctic et al Hecla I-69	I-69-76-20-110-00	Gas				22-02-73	11-04-73	
Panarctic et al Drake D-68	D-68-76-30-108-30	Gas				07-06-73	25-03-74	
Thor Island								
Panarctic et al Thor H-28	H-28 78-10-103-00	Gas	Gas Dev.	Heiberg	Sand-stone	28-02-73	10-05-73	Flow test to 55 MMCF/D
Ellef Ringnes Island								
Panarctic et al Kristoffer Bay B-06	B-06 78-20-102-30	Gas	Gas Discovery	Heiberg	Sand-stone	09-11-71	17-03-72	DST 10 MMCFD

Well Name	Location	Well Status	Reserve Status	Horizon	Lithology	Spud Date	Completion Date	Potential
<i>King Christian Island</i>								
Panarctic King Christian D-18	D-18-77-50-101-00	Abandoned	Gas Discovery	Heiberg	Sandstone	14-10-70	25-01-71	Abandoned after blowout
Panarctic King Christian D-18A	D-18-77-50-101-00	Gas	Gas Dev.	Heiberg	Sandstone	26-11-70	15-03-71	AOF 264 MMCFD
Panarctic et al King Christian N-06	N-06 77-50-101-00	Gas	Gas Dev.	Heiberg	Sandstone	13-05-71	20-09-71	AOF 340 MMCFD
Dome Arctic Ventures Wallis K-62	K-62 78-00-102-00	Gas	Gas Discovery	Heiberg	Sandstone	27-11-72	21-02-73	

Crude Oil Discoveries

Norman Wells Oil Field

Northwest Discovery No. 1	P-37 65-20-126-45	Abandoned	Oil Discovery	Devonian Canol	Fractured Shale	14-4-20	1923	12 bbl/day
Northwest Discovery No. 2	P-37 65-20-126-45	Abandoned	Oil Discovery	Kee Scarp (Givetian)	Limestone	7-24	8-24	75 bbl/day
74 additional wells were drilled to develop field						4-7-39	28-7-68	

Mackenzie Delta-Tuktoyaktuk Peninsula

IOE Atkinson H-25	H-25-69-50-131-45	Abandoned	Potential Oil Well	Lower Cretaceous	Sand	14-12-69	26-02-70	2000 bbls/d IPI DST
IOE Mayogiak J-17	J-17-69-30-132-45	Abandoned	Oil Well	Devonian & L.C.	Carbonate & Sandstone	03-04-71	06-08-71	9300' g.c. Oil 33.6° API TD 12,093' DST
Imp. Ivik J-26	J-26 69-40-134-15	Suspended	Potential Oil & Gas Well	Tertiary	Sandstone	08-04-72	30-09-72	
Imp. Ivik K-54	K-54 69-40-134-15	Abandoned	Potential Oil	Tertiary	Sandstone	30-03-73	08-06-73	
Shell Kugpik O-13	O-13-69-00-135-15	Suspended	Oil	L. Cretaceous	Sandstone	26-03-73	30-09-73	G.T.S. O.T.S.
Imp. Adgo F-28	F-28-69-30-135-45	Plugged & Abandoned	Gas & Oil	Tertiary	Sandstone	28-12-73	19-3-74	O.T.S., G.T.S.

Southern Northwest Territories Mainland

Gas Discoveries

Pan Am Pointed Mountain G-62	G-62 60-30-123-45	Completed Gas Well	Gas Development	Middle Devonian Carbonate	Dolomite	9-7-68	23-6-69	Flow back 12 mmcf/d
Pan Am Pointed Mountain K-45	K-45 60-30-123-45	Suspended gas well	Gas Development	Middle Devonian Carbonate	Dolomite	15-9-67	8-5-68	AOF 225 mmcf/d
Pan Am Pointed Mountain O-46	O-46 60-30-123-45	Gas Well	Gas Development	Nahanni Devonian	Carbonate	29-3-69	2-10-71 Extended Standby	AOF 26 mmcf/d
Pan Am Pointed Mountain P-53	P-53 60-30-123-45	Suspended gas well	Gas discovery	Devonian Nahanni	Dolomite	6-2-66	22-2-67	AOF 75 mmcf/d
Amoco B-2 Pointed Mountain F-38	F-38 60-30-123-45	Gas well	Gas Development	Devonian Nahanni	Dolomite	22-8-72	7-10-73	N/A

Well Name	Location	Well Status	Reserve Status	Horizon	Lithology	Spud Date	Completion Date	Potential
H.B. Cameron Hills A-05	A-05 60-10-117-30	Suspended Gas Well	Gas Discovery	Devonian	Carbonate	28-1-68	24-2-68	DST 8.2 mmcf/d
Sun Netla C-07	C-07 60-50-122-45	Suspended Gas Well	Gas Discovery	Sulphur Point	Carbonate	20-1-61	5-4-61	AOF 24 mmcf/d
Texaco Bovie Lake J-72	J-72 60-10-122-45	Suspended Gas Well	Gas Discovery	Nahanni	Limestone	6-1-70	18-1-70	DST 2.6 mmcf/d
Shell H.B. Grumbler G-63	G-63 60-20-115-45	Abandoned	Potential Gas Discovery	Slave Point	Carbonate	14-2-69	16-3-69	DST 10 mmcf/d
Briggs Rabbit Lake No. 1	O-16 61-00-118-45	Suspended Gas Well	Gas Discovery	Sulphur Point	Limestone	4-2-55	30-3-55	AOF 2 mmcf/d (EST)
Briggs Rabbit Lake No. 2	B-07 61-00-118-45	Suspended Gas Well	Gas Development	Sulphur Point	Limestone	9-2-57	14-3-57	AOF 6 mmcf/d (EST)
Union Pan Am Trainor C-39	C-39 60-20-120-30	Suspended Gas Well	Gas Discovery	Sulphur Point	Carbonate	29-1-65	15-3-65	DST 8 mmcf/d
H.B. Pan Am S. Island R. M-41	M-41 60-10-121-00	Suspended Gas Well	Gas Discovery	Slave Point	Limestone	3-2-64	23-4-64	DST 5.7 mmcf/d
H.B. Amoco S. Island R.M-52	M-52 60-10-121-00	Abandoned	Gas Development	Slave Point	Limestone	21-1-73	21-2-73	DST 1.3 mmcf/d
C.P.O.G. et al La Biche F-08	F-08 60-40-124-30	Suspended	Gas Discovery	Middle Devonian	Argillaceous Limestone	25-2-71	19-3-71	DST 2.9 mmcf/d
Pacific Amoco Tathlina N-18	N-18 60-20-118-00	Suspended Gas Well	Gas Discovery	Slave Point	Limestone	28-1-73	19-2-73	AOF
Home Signal CSP Celibeta No. 2 H-78	H-78 60-10-122-00	Gas Well	Gas Discovery	Slave Point	Limestone	26-12-59	24-3-60	AOF 8 mmcf/d
Ashland et al Tedji Lake K-24		Suspended	Gas			13-02-74	31-3-74	
<i>Mackenzie Delta – Tuktoyaktuk Peninsula</i>								
Gulf Imp. Shell Titalik K-26	K-26-69-10-135-00	Abandoned	Gas Well (DST)	Tertiary	Sandstone	17-10-72	20-02-73	
Shell Niglint-gak H-30	H-30-69-20-135-15	Suspended	Gas Well (DST)	Tertiary	Sandstone	24-10-72	07-04-73	
IOE Taglu G-33	G-33-69-30-134-45	Suspended	Gas	Tertiary	Sandstone	13-04-71	18-08-71	
C-42	C-42-69-30-134-45	Suspended	Condensate	U. Cretaceous		30-04-72	18-11-72	
P-03	P-03-69-30-135-00	Suspended				12-12-71	29-03-72	AOF 308 (calculated) mmcf/d
F-43	F-43-69-30-134-45	Suspended				23-03-73	11-09-73	AOF 30.3 mmcf/d
IOE Mallik L-38	L-38-69-30-135-00	Abandoned	Potential Gas (DST)	Tertiary	Sandstone	24-12-71	05-04-72	I.F. 10.2 mmcf/d CCT

Well Name	Location	Well Status	Reserve Status	Horizon	Lithology	Spud Date	Completion Date	Potential
Gulf Mobil Parsons F-09	F-09-69-00-133-30	Suspended	Gas & Condensate	L. Cretaceous	Sand	20-1-71	19-04-72	17.2 mmcf/d DST
Gulf Mobil Parsons N-10	N-10-69-00-133-30	Suspended	Gas	L. Cretaceous & Jurassic	Sand	14-02-73	29-05-73	FT 34 mmcf/d
Gulf Mobil Parsons P-53	P-53-69-00-133-30	Suspended	Gas & Condensate	Cretaceous	Sand	22-12-73	09-04-74	
Gulf Mobil Ya-Ya P-53	P-53-69-20-134-30	Suspended	Gas Well (DST)	Cretaceous	Sandstone	08-12-72	20-03-73	
Gulf Imp. Shell Reindeer F-36	F-36-69-10-134-30	Suspended	Gas	Tertiary	Sandstone	13-03-73	05-06-73	
Yukon Territory Gas Discoveries								
<i>Beaver River</i>								
Canada Southern et al North Beaver I-27	I-27 60-10-124-00	Suspended	Extension Test Gas Well	Middle Devonian	Carbonate	24-3-63	29-9-64	AOF 1.5 mmcf/d
Pan Am Beaver River YT. G-01	G-01 60-10-124-15	Suspended	Gas Producer	Nahanni	Carbonate	12-6-68	10-3-69	AOF 39.54 mmcf/d
Canoe River Chance YTJ-19	J-19 66-10-137-30	Suspended Gas & Oil	Gas & Oil Discovery	Chance and Permo Penn Alder	Sandstone & limestone	14-12-67	17-2-68	DST 6.52 mmcf/d
WM Chance YT No. 1 M-08	M-08 66-10-137-30	Suspended Gas or Oil Well	Gas & Oil Discovery	Cretaceous Carboniferous Miss. Dev.	Sandstone Sandstone Sandstone	30-5-59	25-5-60	11/64" Choke 5 mmcf/d 10.5 bbl./d
Socony Mobil WM Chance YT G-08	G-08 66-10-137-30	Suspended Oil Well	Gas & Oil Discovery	Lower Cret. Carboniferous Hart River	Sandstone Sandstone	4-12-64	15-2-65	DST 3.3 mmcf/d 1180' oil
Socony Mobil WM Birch YT B-34	B-34 66-10-136-45	Suspended Gas Well	Gas Discovery	Carboniferous Hart River	Sandstone	4-8-64	6-8-65	DST 7.3 mmcf/d
Socony Mobil W M Blackie No. 1 YT M-59	M-59 66-00-137-00	Suspended Gas Well	Gas Discovery	Carboniferous Hart River Miss. Dev.	Sandstone Sandstone	11-12-63	27-3-64	DST 2.8 mmcf/d

Appendix III

Wells Abandoned or Completed in 1973

Northwest Territories – Arctic Islands

Name of Well	Spudded	Completed	Status	Total Depth
BP et al Emerald K-33	12-12-72	13-04-73	D & A	12,010
Deminex et al Orksut I-44	01-01-73	28-03-73	D & A	10,040
Dome et al Wallis K-62	27-11-72	22-02-73	Completed Gas Well	4,030
Elfex Andreasen L-32	09-04-73	30-05-73	D & A	8,625
Elf Intrepid Inlet H-49	10-01-73	18-03-73	D & A	7,050
Horn River et al Depot Point L-24	16-10-72	12-05-73	D & A	5,796
Imp. et al E. Amund M-05	30-05-73	18-08-73	D & A	13,501
Imp. et al Mokka A-02	13-10-72	05-04-73	D & A	10,827
Panarctic Apollo C-73	13-05-73	18-08-73	D & A	12,025
Panarctic Dome Dundas C-80	14-10-72	19-01-73	D & A	13,127
Panarctic Eldridge Bay E-79	06-03-73	06-05-73	D & A	10,000
Panarctic Gemini E-10	14-10-72	15-03-73	D & A	12,614
Panarctic Halcyon O-16	12-04-73	19-05-73	D & A	7,117
Panarctic et al Hecla I-69	22-02-73	11-04-73	Gas Well	4,779
Dome et al Sherard O-34	13-10-73	04-11-73	D & A	4,030
Panarctic et al Isachsen J-37	22-04-73	27-07-73	D & A	13,790
Panarctic et al Louise O-25	23-11-72	04-02-73	D & A	7,483

Panarctic CS May Point H-02	13-06-73	29-08-73	D & A	9,813
Panarctic et al Pollux C-60	27-12-72	31-03-73	D & A	11,249
Panarctic et al Thor H-28	28-02-73	10-05-73	Gas Well	5,760
Panarctic et al W. Pollux E-59	12-10-73	28-10-73	D & A	3,000
Panarctic Zeus F-11	02-05-73	27-05-73	D & A	3,114
Sun et al Linckens Is. P-46	06-03-73	12-05-73	D & A	6,008

Northwest Territories – Mainland

Amoco B-1 East Flett H-13	16-02-73	24-02-73	D&A	2,910
Amoco B-2 Pointed Mountain F-38	22-08-72	07-10-73	Gas Well	15,331
Aquit Brackett L. C-21	16-01-73	01-03-73	D & A	5,041
Aquit Highland L. I-23	04-03-73	17-03-73	D & A	2,735
Aquit Highland L. K-42	03-02-73	01-03-73	D & A	3,849
Aquit Old Fort Point E-30	20-12-72	07-01-73	D & A	2,583
Atkinson et al Trout L. H-57	15-02-73	27-03-73	D & A	6,908
Bluemount et al South Delta J-80	21-12-72	23-02-73	D & A	9,500
CanDel et al Arctic Red F-47	23-12-72	07-03-73	D & A	7,780
CanDel et al Mobil S. Ramparts I-77	17-03-73	14-04-73	D & A	5,351

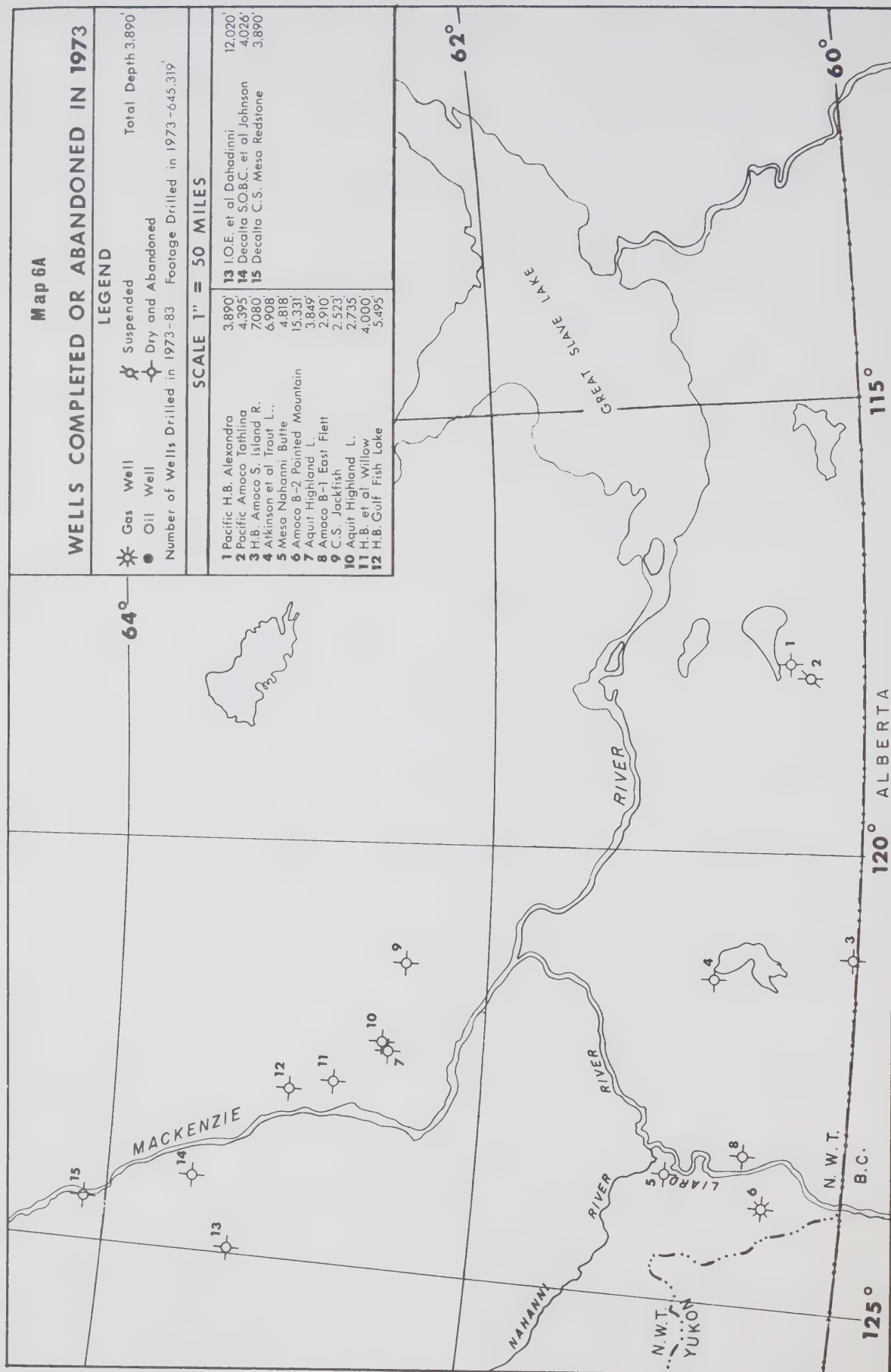
CanDel et al N. Ramparts A-59	22-01-73	11-06-73	D & A	10,515	Imp. Ivik C-52	19-12-72	13-02-73	D & A	10,000
Chevron SOBC Upluk C-21	19-02-73	19-05-73	D & A	5,371	Imp. Ivik K-54	30-03-73	17-06-73	D & A	10,338
CS Bluefish K-71	06-03-73	31-03-73	D & A	5,167	IOE CIGOL Kanguk F-42	27-01-73	15-02-73	D & A	5,070
CS Jack fish N-69	04-03-73	19-03-73	D & A	2,523	Imp. Langley E-29	08-04-73	19-07-73	D & A	12,499
Decalta SOBC et al Johnson A-12	05-03-73	14-04-73	D & A	4,026	Imp. Mallik P-59	30-12-72	02-03-73	D & A	8,636
Decalta et al Keele N-62	20-09-73	21-10-73	D & A	4,199	Imp. CIGOL Natagnak K-53	04-03-73	29-03-73	D & A	5,747
Decalta CS Mesa Redstone P-78	07-01-73	13-02-73	D & A	3,890	Imp. Nuktak P-59	16-12-72	08-03-73	D & A	12,653
Dome Union Stony G-06	13-12-72	17-02-73	D & A	8,300	IOE Taglu F-43	23-03-73	11-09-73	Gas Well	14,944
Elf et al Imp. Amaguk H-16	25-03-73	01-05-73	D & A	4,127	Imp. Umiak J-37	17-12-72	01-03-73	D & A	11,920
Elf et al Kiligvak I-29	16-05-73	09-08-73	D & A	6,447	Imp. Wagnark G-12	18-04-73	05-08-73	D & A	11,719
Gulf Mobil Ikhil I-37	10-04-73	03-12-73	Suspended Temp. Obs. Well	15,432	Inexco Weldon Creek O-65	05-03-73	12-04-73	D & A	7,265
Gulf Mobil Parsons N-10	24-02-73	29-05-73	Gas Well	10,515	Mesa et al Hanna River J-05	17-03-73	04-04-73	D & A	3,230
Gulf et al Reindeer F-36	13-03-73	05-06-73	Suspended Gas Well	6,000	Mesa Nahanni Butte L-20	04-02-73	21-03-73	D & A	4,818
Gulf Imp. Shell Titalik K-26	17-10-72	20-02-73	Abandoned Gas Well	12,600	Pacific HB Alexandra O-54	22-02-73	10-03-73	D & A	3,890
Gulf Mobil Ya Ya P-53	08-12-72	17-03-73	Gas Well	9,950	Pacific Amoco Tathlina N-18	28-01-73	19-02-73	Suspended Gas Well	4,395
HB Gulf Fish Lake G-60	24-02-73	05-04-73	D & A	5,495	Shell Kugpiik O-13	26-03-73	30-09-73	Suspended Oil Well	12,103
HB Amoco S. Island R. M-52	21-01-73	28-02-73	D & A	7,080	Shell Kumak C-58	25-04-73	19-10-73	D & A	11,582
HB et al Willow A-39	21-02-72	11-02-73	D & A	4,000	Shell Niglintgak H-30	24-10-72	07-04-73	Suspended Gas Well	7,817
Imp. CIGOL Akku F-14	09-12-72	01-01-73	D & A	4,990	Shell Unipkat I-22	08-09-72	06-03-73	D & A	14,309
IOE et al Dahadinni I-70	13-01-72	02-03-73	D & A	12,020	Union Aklavik F-38	06-01-73	11-06-73	D & A	6,745
Imp. Immerk B-48	17-09-73	22-12-73	D & A	8,883	Union Mobil Colville D-45	29-03-73	07-05-73	D & A	4,850
Imp. Ivik N-17	10-01-73	04-03-73	D & A	10,004	Union Aklavik F-17	06-01-73	08-02-73	D & A	2,925
					Union Amoco McPherson B-25	08-01-72	12-03-73	D & A	13,570

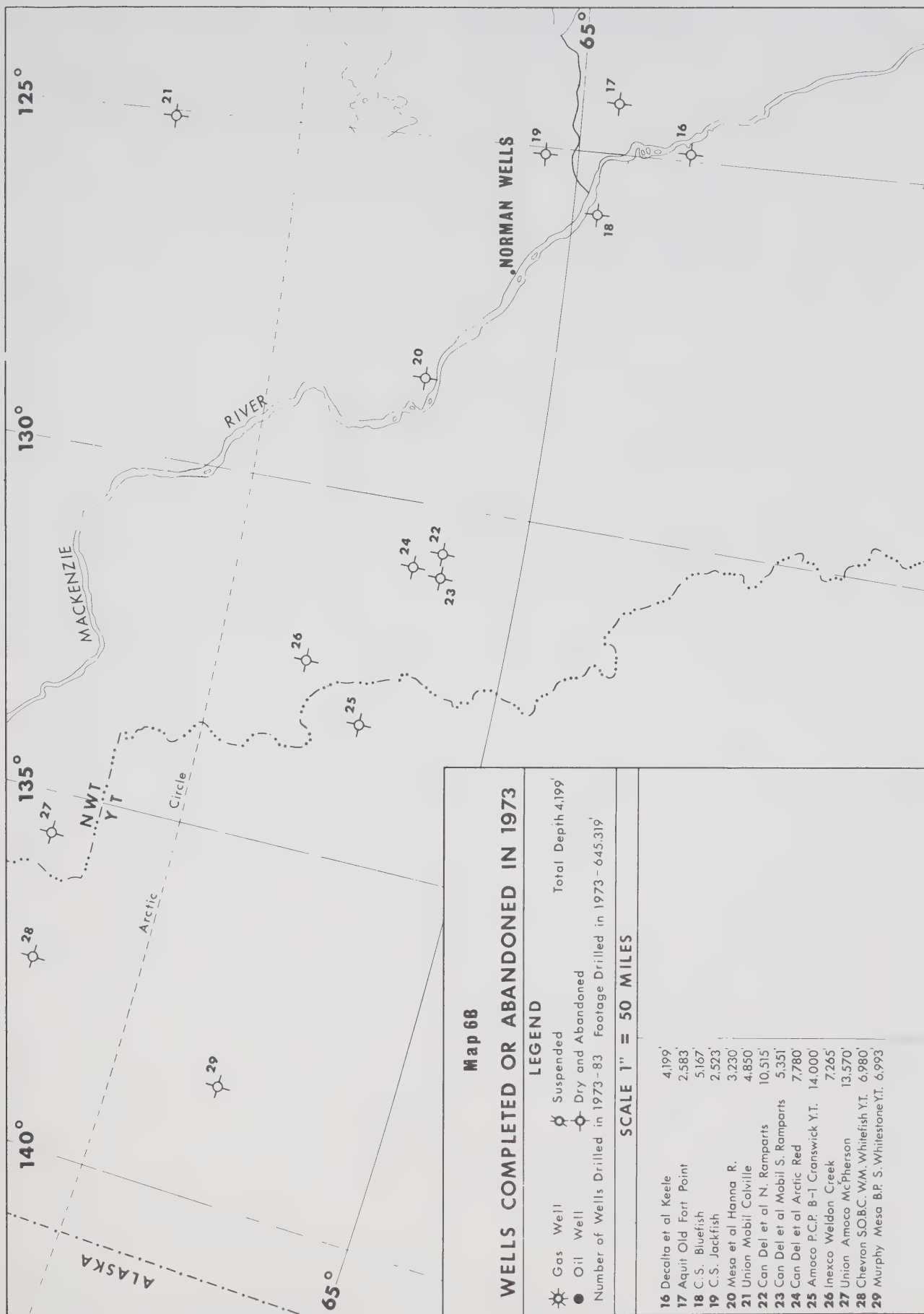
Yukon Territory

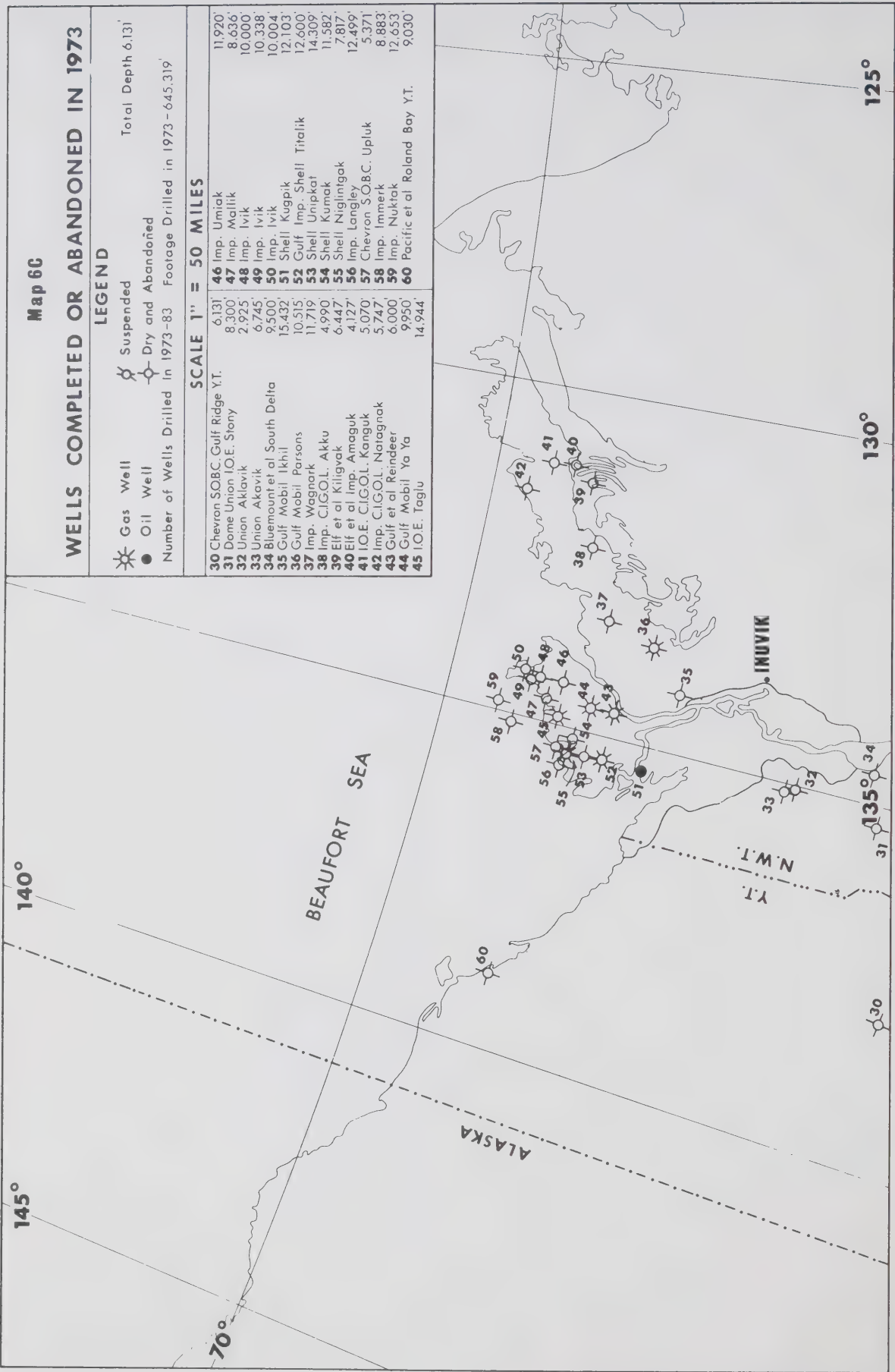
Amoco PCP B-1 Cranswick YT A-42	14-04-72	20-03-73	D & A	14,000
Chevron SOBC Gulf Ridge YT F-48	03-01-73	02-04-73	D & A	6,131
Chevron SOBC WM Whitefish YT J-70	17-01-73	11-04-73	D & A	6,980
Murphy Mesa BP S. Whitestone YT N-58	10-02-73	17-04-73	D & A	6,993
Pacific et al Roland Bay YT L-41	22-12-72	20-04-73	D & A	9,030

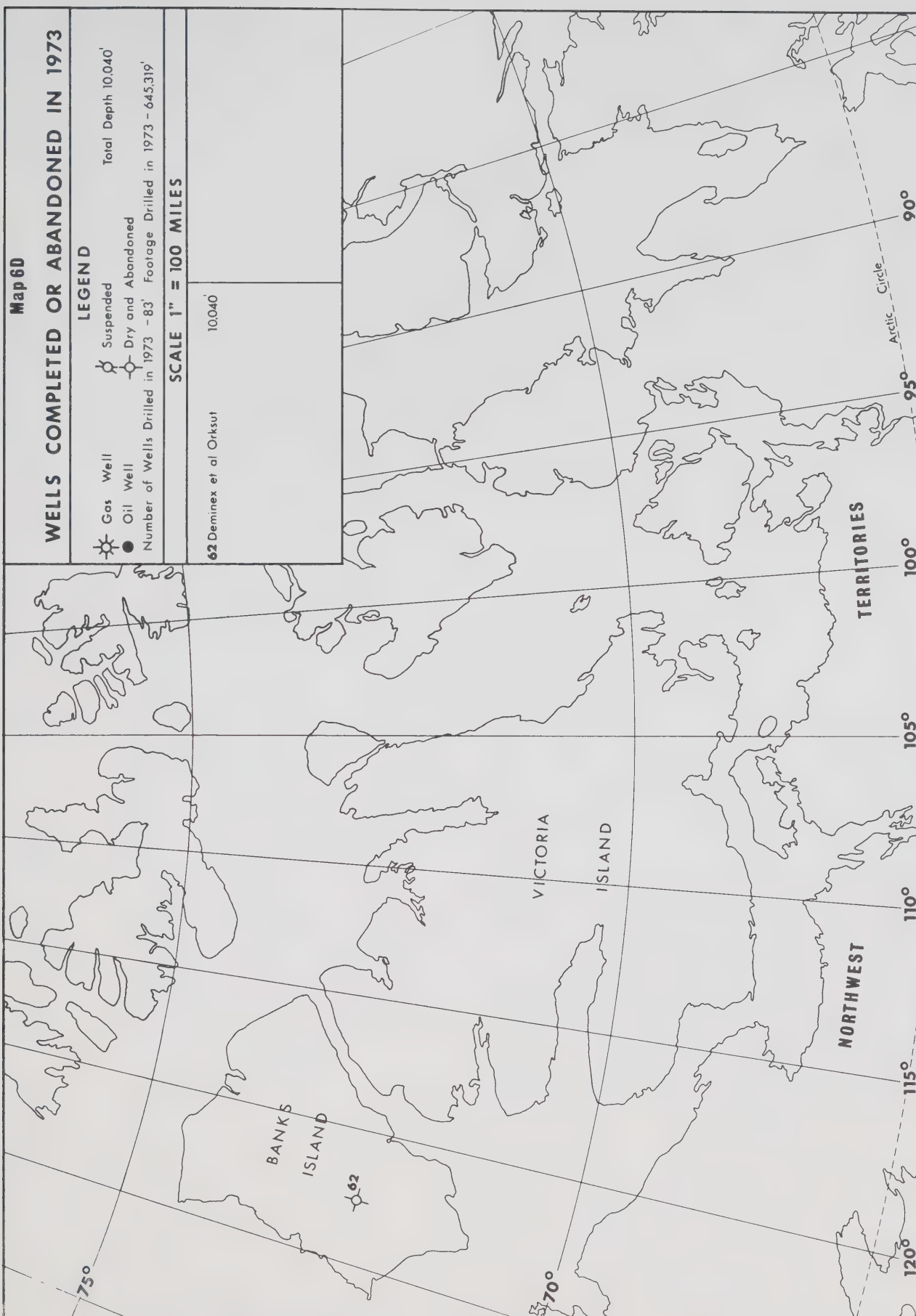
NUMBER OF WELLS DRILLED IN 1973 – 83

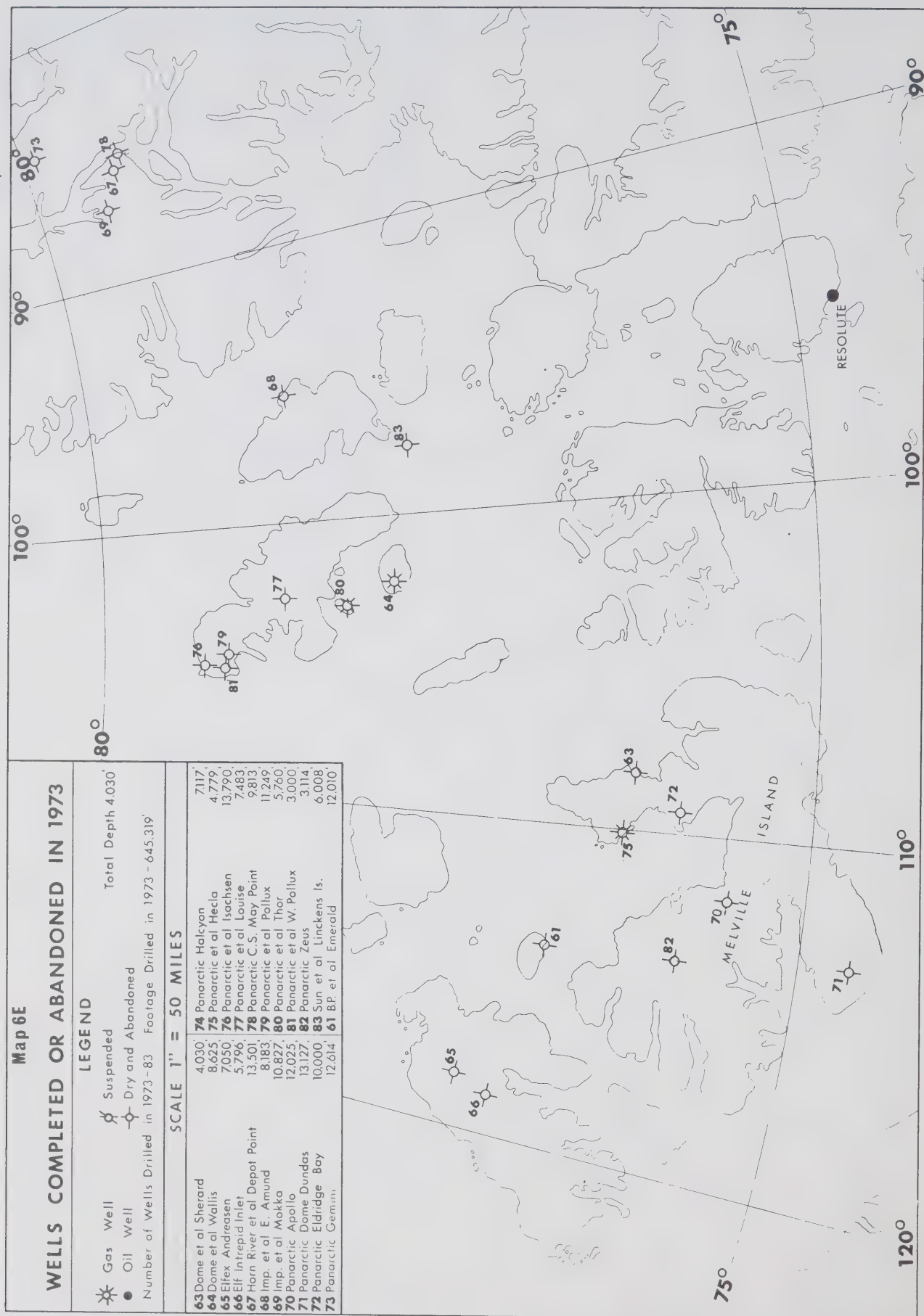
TOTAL FOOTAGE DRILLED IN 1973 – 645,319











Appendix IV

The Oil and Minerals Division is a member of the "Federal Provincial Committee on Energy Statistics" and the "Mines Ministers Subcommittee on Oil and Gas Statistics" and together with the four western provinces and Statistics Canada has standardized all its oil and gas reporting forms. This standardization has removed duplication between government agencies and more important, industry can now process all oil and gas reporting forms from the western provinces and the Yukon and Northwest Territories on computer machines without change of programs.

Form No.	Title of Form
IAN D*52-90-1**	Application for a Drilling Authority
IAN D*52-90-2	Well Completion Data
IAN D*52-90-3**	Application to Amend a Drilling Authority
IAN D*52-90-4**	Application to Change a Well Name
IAN D*52-90-5**	Application to Abandon a Well or Suspend Drilling
IAN D*52-90-6**	Application to Alter Condition of a Well
IAN D*52-90-7	Work-over Report No.
IAN D*52-90-8	Application to Commingle Production before Measurement
IAN D*52-90-9	Data for Back Pressure Test on Natural Gas Wells-Monograph 7 Method
IAN D*52-90-10	Data for Back Pressure Test on Natural Gas Wells-Vitter's Method
IAN D*52-90-11	M.P.R. — Oil Calculations
IAN D*52-90-12	New Oil Well Report
IAN D*52-90-13	New Gas Well Report
IAN D*52-90-17	New Service Well Report
IAN D*52-90-18	Monthly Water Flood Operations Report
IAN D*52-90-20	Monthly Water Receipts and Disposal of Fluid Report
IAN D*52-90-23	Geologic Surface Survey & Airphoto Analysis — Expenditures
IAN D*52-90-24	Land Geophysical Operations—Expenditures
IAN D*52-90-25	Marine Geophysical Programs — Expenditures
IAN D*52-90-26	Drilling & Structure Test Drilling Expenditures
IAN D*52-90-27	Participation Programs — Expenditures

*To be completed by Operator

**To be completed in triplicate; all other forms to be completed in duplicate.

IAN D*52-91**	Notice of Commencement of Exploratory Work
IAN D*52-91-1	Notice of Commencement of Research Work
IAN D*52-92	Application for Authority to Drill Structure Test Hole
IAN D*52-93	Report on Abandonment of Structure Test Hole
IAN D*52-83	Grouping Notice
IAN D*52-103**	Application for Oil and Gas Lease
IAN D*51-183	Monthly Accident Summary

All forms, except IAN D 52-83, IAN D 52-90-23 to IAN D 52-90-17, IAN D 52-91, IAN D 52-91-1, and 52-103, are submitted to the appropriate District Oil and Gas Conservation Engineer.

Forms IAN D 52-83, 52-90-23 to 52-90-27 and 52-103 are submitted to the Oil and Minerals Division, 400 Laurier Avenue West, Ottawa, Ontario. K1A 0H4

Forms IAN D 52-91 and 52-91-1 should be submitted to the Oil and Gas Land and Exploration Section, 112 — 11th Avenue S.E., Calgary, Alberta. T2G 0X5

The following forms have been issued pursuant to the "Canada Oil and Gas Land Regulations" and "Canada Oil and Gas Drilling and Production Regulations". These forms are to be completed when applicable during the production stage and oil and gas wells, and refinery operations.

Form No.	Title of Form
IAN D 52-116-1	Monthly Production Report
IAN D 52-116-2	Monthly Disposition and Crown Royalty Statement
IAN D 52-116-3	Monthly Gas Gathering Statement
DBS 6511-38*	Monthly Oil Pipeline Gathering Operations Statement
IAN D 52-116-5	Monthly Crude Oil and Condensate Purchaser's Statement
IAN D 52-116-6	Monthly Gas Plant Statement
DBS 6511-37*	Monthly Natural Gas Distributors Statement
IAN D 52-116-8	Monthly Gas Processing Plant Products Statement
IAN D 52-116-9	Monthly Liquefied Petroleum Gas Purchaser's Statement
IAN D 52-116-10	Monthly Refinery Operations Report
IAN D 52-116-11	Monthly Gas Injection Operations Report
IAN D 52-116-12	Statement of Nomination and Estimated Requirement of Crude Oil, Condensate and Pentanes Plus

- Notes:* (a) All forms to be completed by Operator.
- (b) Forms 6511-37 and 6511-38 are completed by the Operator in triplicate. He forwards the first two copies to the Oil and Minerals Division in Ottawa, and the third to the District Oil and Gas Conservation Engineer responsible for the District in which the well is located (see Map 3). The other forms listed above are completed in duplicate. The original is submitted to the Oil and Minerals Division in Ottawa and one copy to the appropriate District Oil and Gas Conservation Engineer.

Appendix V

Selected geological references applicable to geological provinces and basins in Northern Canada are listed below. Many others are to be found in the lists of references in Memo 1 of the Canadian Society of the Petroleum Geologists. The Future Petroleum Provinces of Canada – The Geology and Potential; Editor R.G. McCrossan, Calgary, 1973

For a complete list of oil industry technical reports released from confidential status, the reader should refer to the Departmental publication "Technical Reports Available for Inspection – 1974."

Northwest Territories

Geol. Surv. Can.,
Memoir 322

Stratigraphy of Middle Devonian and Older Palaeozoic Rocks of the Great Slave Lake Region Northwest Territories.

A.W. Norris

Geol. Surv. Can.,
Memoir 374

Port Radium Map Area, District of Mackenzie

G. Mursky

Geol. Surv. Can.,
Bulletin 95

Carboniferous and Permian Rocks Southwestern District of Mackenzie

P. Harker

Geol. Surv. Can.,
Bulletin 163
pp. 31-38

"Middle Cambrian Plagiura-Poliella Fanule from Southwest District of Mackenzie"

B.S. Norford

Geol. Surv. Can.,
Bulletin 170

Middle Triassic (Anisian) ammonoids from northeastern British Columbia and Ellesmere Is.

F.H. McLearn

Geol. Surv. Can.,
Bulletin 185

Barremian Textulariina. Foraminiferida from Lower Cretaceous beds, Mount Goodenough section, Aklavik Range, District of Mackenzie

T.P. Chamney

Geol. Surv. Can.,
Paper 58-2

Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains, Northwest Territories.

J.A. Jeletzky

Geol. Surv. Can.,
Paper 58-11

Geol. Surv. Can.,
Paper 61-1

Geol. Surv. Can.,
Paper 61-9

Geol. Surv. Can.,
Paper 65-32

Geol. Surv. Can.,
Paper 66-50

Geol. Surv. Can.,
Paper 67-8

Geol. Surv. Can.,
Paper 67-53

Geol. Surv. Can.,
Paper 68-25

Geol. Surv. Can.,
Paper 68-36

Great Slave and Trout River Map Areas, Northwest Territories (Report and Maps 27-1958 and 28-1958)

R.J.W. Douglas

Summary Account of Carboniferous and Permian Formations, Southwestern District of Mackenzie

P. Harker

Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains, between the Headwaters of Blow and Bell Rivers

J.A. Jeletzky

Geophysical Reconnaissance of Hudson Bay

Peter Hood

Jurassic and Triassic Rocks of the Eastern Slope of Richardson Mountains Northwestern District of Mackenzie

J.A. Jeletzky

Preliminary account of the Goulburn Group, Northwest Territories, Canada

L.P. Tremblay

Reconnaissance Devonian stratigraphy of northern Yukon Territory and northwestern District of Mackenzie

A.W. Norris

Subsurface geology, Lower MacKenzie River and Anderson River area, District of Mackenzie

E.J. Tassonyi

Preliminary notes on the Proterozoic Hurwitz Group, Tavani and Kaminack Lake areas, District of Keewatin

R.T. Bell

Geol. Surv. Can., Paper 68-42	Stratigraphy of the Lower Proterozoic (Aphebian) Great Slave Supergroup, East Arm of Great Slave Lake, District Of Mackenzie P.F. Hoffman	Geol. Surv. Can., Paper 72-19	Description of Carboniferous and Permian stratigraphic sections, northern Yukon Territory and North-western District of Mackenzie E.W. Bamber
Geol. Surv., Can., Paper 68-47	Sekwi Formation, and new Lower Cambrian formation in the southern Mackenzie Mountains, District of Mackenzie R.C. Handfield	Geol. Surv. Can., Paper 72-38	Biostratigraphic determinations of fossils from the subsurface of the Yukon Territory and the District of Franklin, Keewatin and Mackenzie. B.S. Norford, W.W. Brideaux, T.P. Chamney, M.J. Copeland, Hans Frebold, William S. Hopkins, Jr., J.A. Jeletzky, B. Johnson, D.C. McGregor, A.W. Norris, A.E.H. Pedder, E.T. Tozer and T.T. Uyeno
Geol. Surv., Can., Paper 69-9	Stanton Map-area, (107D) Northwest Territories C.J. Yorath and H.R. Balkwill		Upper Devonian ostracod faunas of Great Slave Lake and northeastern Alberta, Canada W.K. Braun
Geol. Surv. Can., Paper 70-12	Geology, Colville Lake map-area and part of Cooper-mine map-area (96 NW And NE, part of 86 NW) Northwest Territories (Report and Map 12-1970) D.G. Cook and J.D. Aitken	Inter Sym. On Dev. System A.S.P.G.	Ambocoeliid brachiopods from the Middle Devonian rocks of northern Canada W.G.E. Caldwell
Geol. Surv. Can., Paper 70-13	Lower and Middle Devonian stromatoporoids from northwestern Canada C.W. Stearn and P.N. Nehrotra	Inter Sym On Dev. Systems A.S.P.G.	Devonian of northern Yukon Territory and adjacent District of Mackenzie A.W. Norris
Geol. Surv. Can., Paper 70-14	Middle Devonian tectonic history of the Tathlina Uplift, southern District of Mackenzie and northern Alberta, Canada. H.R. Belyea	Inter Sym. On Dev. Systems A.S.P.G.	Ramparts, Beavertail and other Devonian Formations C.H. Crickmay
Geol. Surv. Can., Paper 70-30	Tertiary and Cretaceous Biostratigraphic Divisions in the Reindeer D-27 Borehole, Mackenzie River Delta T.P. Chamney	Bulletin of Can. Petroleum Geology Vol. 18, No. 1, pp. 67-79	Clay-Mineralogy and Boron Determinations of the Shales from the Reindeer Well, Mackenzie River Delta P. Bayliss and A.A. Levinson
Geol. Surv. Can., Paper 70-32	Brock River map area, District of Mackenzie (97D) (Report and Map 13-1970) H.R. Balkwill and C.J. Yorath,	Bulletin of Can. Petroleum Geology Vol. 19, No. 2, pp. 437-484	Regional Devonian Geology and Oil and Gas Possibilities, Upper Mackenzie River Area James Law
Geol. Surv. Can., Paper 71-11	Reconnaissance geology, southern Great Bear Plain, District of Mackenzie (Report and Map 5-1971) H.R. Balkwill	Bulletin of Can. Petroleum Geology Vol. 19, No. 3, pp. 570-588	Facies and Faunal Relations of Edge of Early Mid-Devonian Carbonate Shelf, South Nahanni River Area, N.W.T. J.P.A. Noble and R.D. Ferguson
Geol. Surv., Can, Paper 71-15	Biostratigraphic determinations of fossils from the subsurface of the Yukon Territory and the District of Mackenzie, B.S. Norford, M.S. Barss, W.W. Brideaux, T.P. Chamney, W.H. Fritz, William S. Hopkins, Jr., J.A. Jeletzky, A.E.H. Pedder and T.T. Uyeno	Geol. Surv. Can., Maps 1316A, 1317A, 1318A Bulletin of Can. Petroleum Geology Vol. 20, No. 2, pp. 321-361	Oil and Gas Pools of Western Canada N.L. Ball Ordovician to Devonian History of Northern Yukon and adjacent District of Mackenzie A.C. Lenz

Bulletin of Can. Petroleum Geology Vol. 20, No. 3, pp. 498-548	The Horn Plateau Formation: A Middle Devonian Coral Reef. Northwest Territories, Canada L.K. Vopni and J.F. Lerbekmo	Geol. Surv. Can., Paper 68-26	Lower Cretaceous (Albian) of the Yukon: Stratigraphy and Foraminiferal subdivisions, Snake and Peel Rivers E.W. Mountjoy and T.P. Chamney
Can. Soc. Petrol. Geol., Memoir 1	Tathlina Area, Southern District of Mackenzie. R. de Wit, E.C. Gronberg, W.B. Richards and W.O. Richmond	Geol. Surv. Can., Paper 70-15	Biostratigraphic determinations of fossils from the subsurface of the Yukon Territory and the District of Mackenzie and Franklin B.S. Norford, W.K. Braun, T.P. Chamney, W.H. Fritz, D.C. McGregor, A.W. Norris, A.E.H. Pedder and T.T. Uyeno
Can. Soc. Petrol. Geol., Memoir 1	Anderson Plain, Northern District of Mackenzie David F. Gilbert		
Can. Soc. Petrol. Geol., Memoir 1	Beaufort Sea Monti Lerand	Geol. Surv. Can., Paper 71-15	Biostratigraphic determinations of fossils from the subsurface of the Yukon Territory and the District of Mackenzie B.S. Norford, M.S. Barss, W.W. Briedeaux, T.P. Chamney, W.H. Fritz, Williams S. Hopkins, Jr., J.A. Jeletzky, A.E.H. Pedder and T.T. Uyeno
Can. Soc. Petrol. Geol., Memoir 1	Canadian Arctic Islands K.J. Drummond		
Can. Soc. Petrol. Geol., Memoir 1	Labrador Sea and Baffin Bay N.J. McMillan	Geol. Surv. Can., Paper 72-38	(see page 3 of Appendix V)
<i>Eagle Plain and Northern Yukon</i> Geol. Surv. Can., Memoir 247	Physiography of the Canadian Cordillera with a Special Reference to the Area North of the Fifty-Fifth Parallel H.S. Bostock	Inter Sym. On Dev. Systems A.S.P.G.	Upper Silurian and Lower Devonian biostratigraphy, Royal Creek, Yukon Territory, Canada A.C. Lenz
Geol. Surv. Can., Paper 61-9	Upper Jurassic and Lower Cretaceous Rocks, West Flank of Richardson Mountains between the Headwaters of Blow and Bell River, Yukon Territory J.A. Jeletzky	Bulletin of Can. Petroleum Geology Vol. 18, No.3, pp. 407-429	Age and Fauna of the Michelle Formation, Northern Yukon Territory R. Ludvigsen
Geol. Surv. Can., Paper 63-39	Reconnaissance of the Ordovician and Silurian Rocks of Northern Yukon Territory B.S. Norford	Bulletin of Can. Petroleum Geology Vol. 19, No. 1, pp. 29-249	Carboniferous and Permian Stratigraphy and Paleontology, Northern Yukon Territory, Canada E.W. Bamber and J.B. Waterhouse
Geol. Surv. Can., Paper 66-39	Descriptions of Devonian Sections in Northern Yukon and Northwestern District of Mackenzie A.W. Norris	Can. Soc. Petrol. Geol., Memoir 1	Eagle Plain Basin Henry L. Martin
Geol. Surv. Can., Paper 67-53	Reconnaissance Devonian Stratigraphy of Northern Yukon Territory and Northwestern District of Mackenzie A.W. Norris	Can. Soc. Petrol. Geol., Memoir 1.	Old Crow Basin J.R. Lawrence
Geol. Surv. Can., Paper 68-18	Stratigraphy and Palynology of a Permian Section, Tatonduk River, Yukon Territory E.W. Bamber and M.S. Barss	<i>Southern Yukon</i> Can. Soc. Petrol. Geol., Memoir 1	Central Cordilleran Region N. Gale Koch
		<i>Sverdrup Basin</i> Geol. Surv. Can., Memoir 320	Geology of the North Central Part of the Arctic Archipelago, Northwest Territories (Operation Franklin) Y.O. Fortier et al.

Geol. Surv. Can., Memoir 331	Geological Reconnaissance of North-eastern Ellesmere Island, — District of Franklin R.L. Christie	Geol. Surv. Can., Paper 71-12	Reconnaissance of Lower Paleozoic geology, Phillips Inlet region, north coast of Ellesmere Island, District of Franklin H.P. Trettin
Geol. Surv. Can., Memoir 332	Western Queen Elizabeth Islands, Arctic Archipelago E.T. Tozer & R. Thorsteinsson	GSC Bull 171	Pre-Mississippian Geology of Northern Axel Heiberg and NW Ellesmere Islands, Arctic Archipelago H.P. Trettin
Geol. Surv. Can., Paper 60-7	Summary Account of Structural History of the Canadian Arctic Archipelago since Precambrian Time R. Thorsteinsson and E.T. Tozer	GSC Bull 183	Geology of Ordovician to Pennsylvanian Rocks, M'Clintock Inlet, north coast of Ellesmere Island, Arctic Archipelago H.P. Trettin
Geol. Surv. Can., Paper 63-30	Mesozoic and Tertiary Stratigraphy, Western Ellesmere Island and Axel Heiberg Island E.T. Tozer	GSC Bull 203	Geology of Lower Paleozoic formations, Hazen Plateau and southern Grant Land Mountains, Ellesmere Island, Arctic Archipelago H.P. Trettin
Geol. Surv. Can., Paper 66-34	Lower Triassic Tar Sands of Northwestern Melville Island, Arctic Archipelago H.P. Trettin and L.V. Hills	GSC Map 10-1968	Southern Ellesmere Island, District of Franklin J.Wm. Kerr
Geol. Surv. Can., Paper 66-55	Ordovician Stratigraphic Section at Daly River, Northeast Ellesmere Island, District of Franklin B.S. Norford	Department of Energy, Mines & Resources, scale: 1:1,000,000	Glacier map of northern Queen Elizabeth Islands (District of Franklin) W.E. Kenock and A. Stanley
Geol. Surv. Can., Paper 67-27 pt I	Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada. Proterozoic and Cambrian J. Wm. Kerr	Bulletin of Can. Petroleum Geology Vol. 12, No. 3, Sept. 1964	Piercement Structures in the Arctic Islands Don B. Gould & George de Mille
Geol. Surv. Can., Paper 67-27 pt II	Stratigraphy of Central and Eastern Ellesmere Island, Arctic Canada, Ordovician J. Wm. Kerr	Bullet of Can. Petroleum Geology Vol. 13, No. 1, March 1965	Lower Paleozoic Salt, Canadian Arctic Islands R.H. Workum
Geol. Surv. Can., Paper 68-16	Ellef Ringnes Island, Canadian Arctic Archipelago D.F. Stott	Bulletin of Can. Petroleum Geology Vol. 19, No. 3, pp. 659-679	Geology of the Sverdrup Basin B.P. Plauchut
Geol. Surv. Can., Paper 68-17	Mesozoic and Tertiary stratigraphy at Lake Hazen, northern Ellesmere Island, District of Franklin A.A. Petryk	Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp. 705-729	Upper Devonian Stratigraphy, Northeastern Banks Island, N.W.T. J.E. Klován and A.F. Embry III
Geol. Surv. Can., Paper 68-31	Upper Paleozoic and Mesozoic Stratigraphy in the Yelverton Pass Region, Ellesmere Island, District of Franklin W.W. Nassichuk and R.L. Christie	Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp. 730-781	A Late Devonian Reef Tract on Northeastern Banks Island, N.W.T. Ashton F. Embry III and J.E. Klován
Geol. Surv. Can., Paper 68-44	Analysis of aeromagnetic data over the Arctic Islands and Continental Shelf of Canada B.K. Bhattacharyya	Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp.782-798	Brachiopoda of the Melville Island Group (Upper Devonian), Banks Island, N.W.T. Jonathan W. Harrington

Bulletin of Can. Petroleum Geology Vol. 19, No. 4 pp. 799-811	Upper Devonian Megaspores, North-eastern Bank Island, N.W.T. L.V. Hills, R.E. Smith and A.R. Sweet	Geol. Surv. Can., Paper 71-21	Massive ice and icy sediments throughout the Tuktoyaktuk Peninsula, Richard Island, and nearby areas, District of Mackenzie V.N. Rampton and J. Ross Mackay
Bulletin of Can. Petroleum Geology Vol. 19, No. 4, pp. 812-813	Mineralogy of the Upper Devonian Strata Along Northeastern Banks Island, N.W.T. P. Bayliss	Defense Research Board	Ice Atlas of Arctic Canada C. Swithinbank
Can. J. Earth Sci. Vol. 18, No. 4, pp. 463-468	Geology of an outstanding aerial photograph at Cape Storm, Southern Ellesmere Island, Arctic Canada J.Wm. Kerr	<i>Arctic Lowlands</i> Geol. Surv. Can., Paper 63-44	Surficial Geology of Boothia Peninsula and Somerset, King William and Prince of Wales Islands, District of Franklin B.G. Craig
AAPG Memoir 8 pp. 183-214	Piercement structures in Canadian Arctic Islands (In Diapirism and diapirs — a symposium: American Association of Petroleum Geologists) D.B. Gould and G. De Mille	Geol. Surv. Can., Paper 64-47	Lower Palaeozoic Sediments of North-western Baffin Island, District of Franklin H.P. Trettin
Bull. Can. Petroleum Geology Vol. 20, No. 1, pp. 175-183	Geology of outstanding Arctic aerial photographs, Schei Summit area, Central Ellesmere Island J. Wm. Kerr	In Arctic, Vol. 21, No. 2, pp. 84-91	The Peel Sound Formation (Devonian of Prince of Wales and adjacent Islands) — a preliminary report D.S. Broad and others
In Journal of Glaciology, Vol. 8, No. 52, pp. 23-50	Glacial features of Tanquary Fiord and adjoining areas of northern Ellesmere Island, N.W.T. G. Hattersley-Smith	In Can. Journal of Earth Science, Vol. 5, No. 4, pt I pp. 791-799	Sedimentary and paleontological features of the Tertiary-Cretaceous rocks of Somerset Island, Arctic Canada D.L. Dineley and B.R. Rust
Oilweek, Vol. 20, No. 1, pp. 73-75	Bright glitter of Arctic black gold H. Heise	In Journal of Paleontology Vol. 43, No. 1, pp. 1-27	Yukon Territory and Devon Island, Canada, with a section on Devon Island stratigraphy, by A.R. Ormiston G. Klapper
Inter Sym. On Dev. System A.S.P.G.	Devonian of the Franklin miogeosyncline and adjacent Central Stable Region, Arctic Canada J.W. Kerr	GSC Map 6-1969 (with notes)	Lac Belot map-area, Northwest Territories. J.D. Aitken and D.G. Cook
Inter Sym. On Dev. System A.S.P.G.	Devonian on the Franklinian eugeosyncline H.P. Trettin	Journal of Paleontology	Helicoprion sp. and Ellasmonbranch found in Permian rocks on Ellesmere Island, Canadian Arctic W.W. Nassichuk and Claude Spinosa
Bulletin of Can. Petroleum Geology Vol. 20, No. 4, pp. 651-658	Permian-Triassic Boundary in the Canadian Arctic Archipelago W.W. Nassichuk, R. Thorsteinsson and E.T. Tozer	In Maritime Sediments, Vol. 4, No. 2, pp. 69-72	The submersibles PICES feasibility study in the Canadian Arctic B.R. Pelletier
<i>Arctic Coastal Plains and Continental Shelf</i> Geol. Surv. Can., Paper 63-22	Marine Geology, Eastern Part of Prince Gustaf Adolf Sea, District of Franklin J.L. Marlowe	Bull. Geol. Soc. Am. Vol. 80, No. 1, Jan. 1969 pp. 143-148	A Paleozoic-Tertiary Fold Belt in northernmost Ellesmere Island aligned with the Lomonosoy Ridge H.P. Trettin
Geol. Surv. Can., Paper 68-27	Geology of the eastern part of the northern interior and Arctic Coastal Plains, Northwest Territories C.J. Yorath, H.R. Balkwill and R.W. Klassen	In Micropaleontology Vol. 15, No. 1, pp. 35-60	Recent foraminifera in the Canadian Arctic G. Vilks

Geol. Surv. Can., Paper 72-37	Description, Palynology and Pale- oecology of the Hassal Formation (Cretaceous) on eastern Ellef Ringnes Island, District of Franklin W.S. Hopkins, Jr., and H.R. Balkwill	Geol. Surv. Can., Paper 64-47	Lower Palaeozoic Sediments of North- western Baffin Island, District of Franklin H.P. Trettin
In Journal of Paleont- ology Vol. 43, No. 1, pp. 28-40	Permian Strophalosiidae (Brachio- poda) from the Canadian Arctic Archipelago J.B. Waterhouse	Maritime Sediments, Vol. 4, No. 1 pp. 4-6	Sedimentological survey of Baffin Bay J.J. Blee
Can. Journal of Earth Sciences Vol. 9, No. 6	Geophysical and Geological Studies in Eastern and Northern Baffin Bay and Lancaster Sound M.S. Keen, S. Johnson, I. Park	Geol. Surv. Can. Bull. No. 157	Lower Palaeozoic sediments of North- western Baffin Island H.P. Trettin
<i>Franklinian Geosyncline</i> Geol. Surv. Can., Memoir 294	Cornwallis and Little Cornwallis Islands, District of Franklin, North- west Territories R. Thorsteinsson	Can. Journal of Earth Sciences Vol. 9, No. 3	Geophysical Studies in Baffin Bay and some Tectonic implications C.E. Keen, D.L. Bassett, K.S. Manchester, and D.I. Ross
Geol. Surv. Can., Memoir 309	Permian Rocks and Fauna of Grinnell Peninsula, Arctic Archipelago P. Harker and R. Thorsteinsson	Map	Glacier map of southern Baffin Island and Northern Labrador Peninsula (Department of Energy, Mines and Resources, scale 1:1,000,000) 1968
Geol. Surv. Can., Memoir 316	Triassic Stratigraphy and Fauna, Queen Elizabeth Islands, Arctic Archipelago E.T. Tozer	<i>Hudson Bay Basin and Lowlands</i> Geol. Surv. Can. Paper 59-13	Aeromagnetic Surveys Across Hudson Bay from Churchill to Coral Harbour and Churchill to Great Whale River M.E. Bower
Geol. Surv. Can., Memoir 330	Banks, Victoria and Stefansson Islands, Arctic Archipelago (Report and Map 1135A) R. Thorsteinsson and E.T. Tozer	Geol. Surv. Can., Paper 60-20	Belcher Islands, Northwest Territories G.D. Jackson
Bulletin Canadian Petroleum Geology Vol. 13, No. 1	Middle Ordovician to Middle Silurian Carbonate Cycle, Brodeur Peninsula, Northwestern Baffin Island H.P. Trettin	Geol. Surv. Can., Paper 63-48	Sedimentology of Hudson Bay, District of Keewatin R.J. Leslie
Bulletin Canadian Petroleum Geology Vol. 15, No. 1	New Nomenclature of Ordovician Rock Units of the Eastern and Southern Queen Elizabeth Islands, Arctic Canada J.Wm. Kerr	Geol. Surv. Can., Paper 67-24	Stratigraphic sections of Palaeozoic Rocks on Prince of Wales and Somerset Islands, District of Franklin, N.W.T. R.L. Christie
<i>Foxe Basin and Baffin Island</i> Geol. Surv. Can., Paper 62-35	Notes with Map 3 — 1958 and Map 4 — 1958 (Fury and Hecla Strait; Foxe Basin North) R.G. Blackadar	Geol. Surv. Can., Paper 67-60	Geology of the Hudson Bay Lowlands, Operations Winisk B.V. Sanford, A.W. Norris and H.H. Bostock
Geog. Bull. 4 pp. 1-29	The Island in Foxe Basin; Geo. Br. Department of Mines and Technical Surveys	Geol. Surv. Can., Paper 69-8	Ordovician and Silurian bio- stratigraphy of the Sogepet-Aquitaine Kaskattama Province No. 1 well, northern Manitoba B.S. Norford
		Geol. Surv. Can., Bulletin 164	Silurian cephalopods of James Bay Lowland, with a revision of the family Nartheccerataidae R.H. Flower

In Can. Journal of
Earth Sciences, Vol. 5,
No. 5, pp. 1297-1303

An analysis of the crust-mantle
boundary in Hudson Bay from gravity
and seismic observations

J.R. Weber and A.K. Goodacre

Additional Maps

GSC Map 1298A

Slidre Fiord Map-Area, Ellesmere
Island, Canadian Arctic Archipelago

R. Thorsteinsson

GSC Map 1299A

Middle Fiord Map-Area, Arctic Islands

R. Thorsteinsson

GSC Map 1300A

Eureka Sound south Map-Area, Arctic
Islands

R. Thorsteinsson

GSC Map 1301A

Strand Fiord Map-Area, Arctic Islands

R. Thorsteinsson

GSC Map 1302A

Eureka Sound north Map-Area, Arctic
Islands

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GSC Map 1303A

Haig-Thomas Island Map-Area, Arctic
Islands

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GSC Map 1304

Glacier Fiord Map-Area, Arctic Islands

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GSC Map 1305A

Cape Stallworthy Map-Area, Arctic
Islands

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GSC Map 1306A

Tanquary Fiord Map-Area, Arctic
Islands

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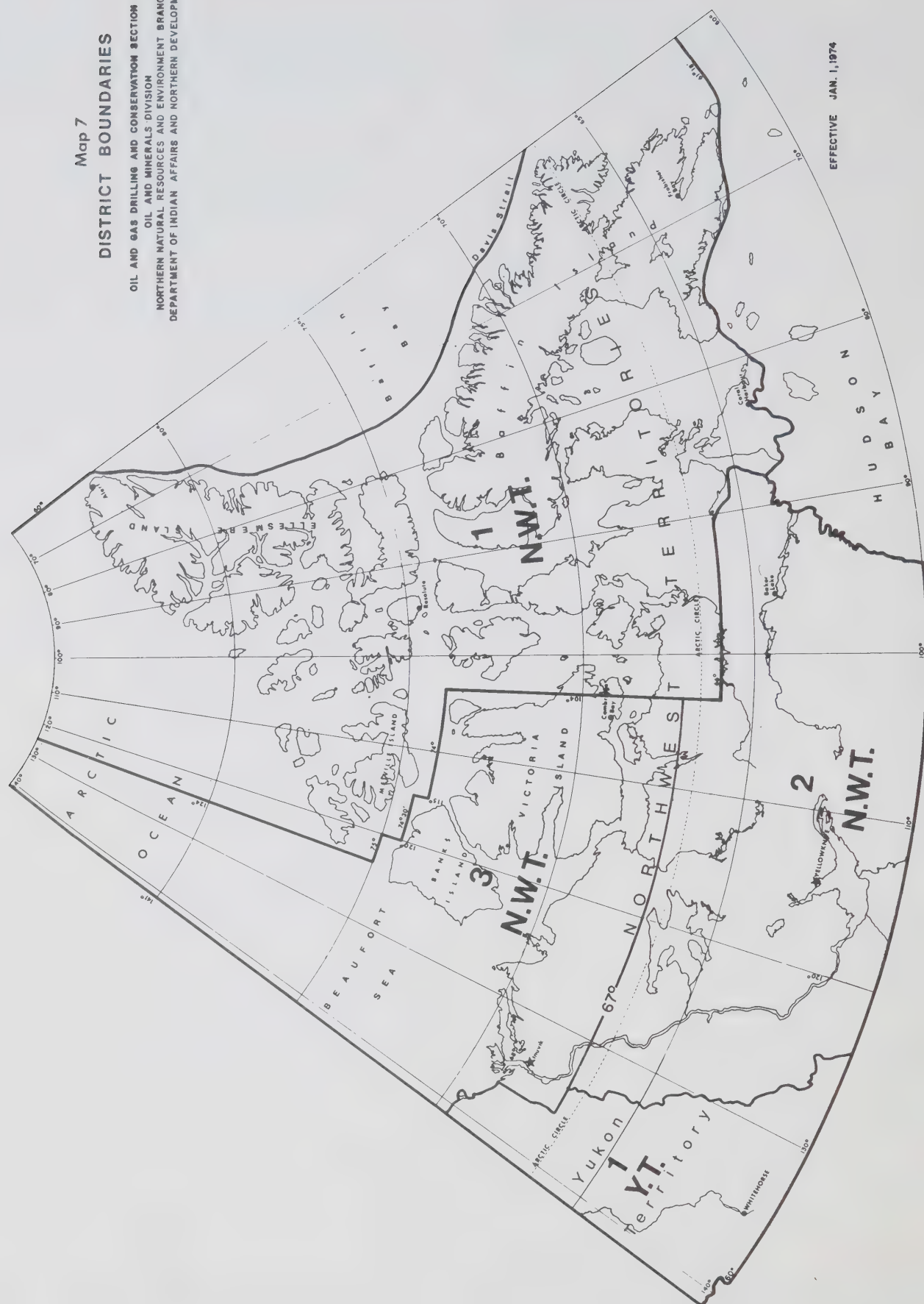
GSC Map 1307A

Strathcona Fiord-Area; Arctic Islands

R. Thorsteinsson

DISTRICT BOUNDARIES

OIL AND GAS DRILLING AND CONSERVATION SECTION
OIL AND MINERALS DIVISION
NORTHERN NATURAL RESOURCES AND ENVIRONMENT BRANCH
DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT



EFFECTIVE JAN. 1, 1974

JUL 2 1987

